Western Calculator 28

Subtraction Application

Application

1. Add 125 + 16 + 2060 + 8004574 + 6

Ans. 8011804.

```
      125
       23
       16
     2060
  8004574
        6
  8011804
  8011679
  8011804
```

2. Add one hundred and twenty-nine, six hundred and fifty-four, eight thousand and seventy, ten thousand, and four millions. Ans 4018853.

```
      129
      654
     8070
    10000
  4000000
  4018853
  4018724
  4018853
```

3. If i have received 125 dollars from A, 286 from B, 29 from C, 672 from D, how much have I received from all four? Ans 1112.

```
   125
   286
    29
   672
  1112
   787
  1112
```

4. Bought 60 barrels of flour from one man for 480 dollars 75 barrels from

4. Bought 60 barrels of flour from one man for 480 dollars. 75 barrels from another for 675 dollars 220 from another for 2200 dollars. and 126 from another for 1386 dollars: how many barrels of flour had I. and how much did they cost me? Ans 481 barrels. and cost 4741 dollars

```
   60
   75
  220
  126
  481
  421
  481
```

```
   480
   675
  2200
  1386
  4741
  4261
  4741
```

```
  100000000
   99999999
  000000001
  100000000
```

1. Multip...

2200...

2420000 0000

M Multiplication Multiplication

7

78965957
5893
236897961
71 693853
7 27896
631 29935
39 4 8
465346561391

115
75
575
806
8625

8. what will 75 bushels of wheat come to, at 1,15 cents per bushel.
Ans. 86 dollars. 25 cents.

115
75
575
806
8625

9. bought 3950 lbs. of coffee. at 29 cents per lb. what must I pay.
Ans. 1145 dollars. 50 cents.

3950
29
35550
7900
114550

10. there are 12 pence in one shilling. how many are there in 40:
Ans. 480 pence

40
12
80
40
480

when the multiplier is the exact product of any two factors in the multiplication table.

Rule
Multiply the given num by one of thes: and that product multiplied by the other: will give the number required.

Examples

1. Multiply 4236 by 16.
4

1

4236
4
16944
4
67776

2. Multiply 871075 by 21 Ans. 18292575

871075
21
871075
1742150
18292575

3

2453642
36
14721852
7360926
88331112

4

43102
64
172408
258612
2758528

5

23645
144
94580
94580
23645
3404880

6

12071
99
108639
108639
1195029

1. Multiply 240 by 20. Ans. 4800

240
20
000
480
4800

2

3600
400
0000
0000
1440
1440000

3

550000
44000
0000000
0000000
2200000
2200000
24200000000

Multiplication

4.

1.

2.

1. A gentleman owes 25 laborers 15 Dollars each. how much does the whole come to? Ans. 375 dollars

2. A saddler owes his Journeyman for 43 days work at 125 cents per day. how much does he owe him in all? Ans. 53 dollars 75 cents

3. A merchant buys 440 yards of muslin at 32 cents per yard: how much does the whole cost? Ans. 140 dollars. 80 cents

Multiplication (mutti)

4. A farmer sells 60 bushels of wheat at 125 cents per bushel: 40 bushels of rye at 85 cents: 34 of corn at 50 cents; how much is he to receive for each, and how much does the whole amount to?

Ans. 75.00 cents for the wheat. 34.00 cents for the rye 17.00 cents for the corn, and the whole amounts to 126.00 cents, or 126 dollars.

5. A dollar is equal to 10 dimes. and to and a dime is equal to 10 cents: how many dimes and cents are there in 100 dollars Ans 1000 dimes, on 10.000 cents

1000 dimes

Multiplication

7. How many panes of glass are there in a house that has 32 windows. 20 of which have 24 lights each. and the rest have 18 each?

Ans. 696 panes

18
12
36
18
216

24
20
00
48
000

480
216
696
216
696

8. A has 250 dollars. B has three times as many. and C has four times as many as B: how many dollars have B. and C. each. and how many have they altogether?

Ans. B has 750 dlls. C 3000 dollars. altogether 4000 dollars

250
3
750

750
4
3000

250
750
3000
4000
3750
4000

Division

2) 46578238
23289119
2
46578238

3) 67224513 9
22408171 3
3
67224213 9

4) 44756394344
11189098586
4
44756394344

5) 97036142
19407228 ..2
5
97036142

8) 27846210
4730776 - 2
8
37846210

12) 64381259
5365104 ..11
12
64381259

6) 38249 66
6374 94 ...2
38249 66

7) 46825486
6689355 ...1
7
46825486

9) 8297463813
721940423 ...6
9
8297463813

Division Division

Division

examples

Devidend

Divis 112) 9870 (235
84
147
126
210
210

1: 24) 4870 (411
96
27
24
30
24
6
9870

2: 41) 94777 (2316
82
129
123
67
41
269
226
43
94779

3 64) 29687624 (4638679
256
408
384
247
192
556
512
442
384
584
576
8
29687624

4: 735) 47989536925 (65291886
4410
3889
3675
2145
1470
6753
6615
1386
735
6519
5880
6392
5880
5125
4410
715
47989536925

5: 2364) 4917968467 (2084768
4718
19996
18872
11248
9436
18129
16518
16166
14134
20127
18872
1255

6: 671) 5374608 (8009
5368
6608
6039
569

Federal Money

McCormick's Federal Money Book

Examples of Addition

1.

```
  E   d  d  c  m
 25 · 6 · 4 · 8 · 2
 24 · 7 · 6 · 2 · 4
 63 · 8 · 1 · 3 · 5
 92 · 2 · 3 · 4 · 6
 ------------------
206 · 4 · 5 · 8 · 7
180 · 8 · 1 · 0 · 5
206 · 4 · 5 · 8 · 7
```

2.

```
    D       C
  5675  · 25
  2356  · 63
  3972  · 80
  7285  · 75
  ------------
 19320  · 43
 13645  · 18
 19320  · 43
```

3.

```
      D      C
  53258 · 75 1/4
  93620 · 33 1/2
  31076 · 56 3/4
  27532 · 35
  ----------------
 205488 · 00 1/2
 152229 · 25 1/4
 205488 · 00 1/2
```

4.

```
   E    d   d   c   m
  83 ·  6 · 5 · 3 · 5
  32 ·  9 · 3 · 7 · 5
  ---------------------
 116 ·  5 · 9 · 1 · 0
  32 ·  9 · 3 · 7 · 5
 116 ·  5 · 9 · 1 · 0
```

5.

```
      D       C
  653980 · 25 1/2
  328763 · 31 1/4
  982743 · 56 3/4
  328763 · 31 1/4
  982743 · 56 3/4
```

6.

```
    E   d   d   c  m
   23 · 6 · 3 · 5 · 7
                   3
   ------------------
3) 70 · 9 · 0 · 7 · 1
   23 · 6 · 3 · 5 · 7
```

7.

```
      D      C
    2637 · 25
             6
   -----------
6) 15823 · 50
    2637 · 25
```

8.

```
      D      C
    6378 · 75 1/2
              9
   ---------------
9) 57408 · 79 1/2
    6378 · 75 1/2
```

9.

```
    E   d   d   c   m
2) 63 · 3 · 8 · 6 · 2
   31 · 6 · 9 · 3 · 1
                    2
   -------------------
   63 · 3 · 8 · 6 · 2
```

10.

```
      D      C
5)  3632 · 75
     726 · 55
           5
    3632 · 75
```

11.

```
      D      C
8) 82750 · 33
   10343 · 79 - 1
               8
   --------------
   82750 · 33
```

Federal Money

Federal mony Money

Promiscuous questions.

1 Add 25 eagles. 62 dollars. 8 dimes. 75 cents. and 5 mills. Ans. 313d 55c 5 m:

E	D	d	c	m
2	5	0	0	0	0

2 5 0 0 0 0
6 2 0 0 0
8 0 0
7 5 0
5
3 1 3 5 5 5

2 A person deposited at bank 1055 dollars in notes 260 dollars in gold. 3650 dollars in silver and 2 50 cents how much is the amount: Ans. 4967d 50c

D C
1055
260
3650
2.50
4967.50

3: Bought a barrel of sugar for 39 dollars 87½ cents. a bag of coffee for 22 dollars 18¾ cents and a pound of tea for 2 dllars 12½ cents: how much do they all cost: Ans. 64d 18¾ C.

D C
39 . 87½
22 . 18¾
2 . 12½
64 . 18¾

4. Bought goods to the amount of 645 dollars 95¾ cents and paid at the time of purchase 350 dollars: how much remains to be paid.

Ans 295d

D C
645 . 95¾
350 . 000
295 . 95¾

5. A man lent his friend 1000 dollars. and received at sundry payments. first 160 dollars 25 cents. second 285 dollars 66½ cents. third 300 dollars 28¾ cents. what re-mains yet to be paid:

Ans. 253d 79¾ C.

D C
1000 :
746 . 20¼
253 . 79¾

6. What is the product of 102 dollars 19 cents multiplied by 120?

Ans. 12262d 80c.

102 : 19
1 . 20
000 00
20438
10219
12262 80

7. What will 16 barrel of flour amount to at 4 dollars 50 cents per barrel: Ans. 72 d

450
16
2700
450
72:00

Federal. Money James McCormick

8. How much will 132 pieces of calico come to at 17 dollars 37½ cents a piece: Ans. 2293d 50c:

```
  1737½
    132
  -----
   3474
  5211
 1737
     66
 ------
 229350
```

9. What is the quotient of 6022 dollars 50 cents. divided by 5:
Ans. 1204d 50c.

```
5)6022.50
  1204.50
        5
  6022.50
```

10. A bucher bought 18 beef cattle for 252 dollars 90 cents. how much did he pay for each: Ans. 14d 05c.

```
18)252:90(14d05c
   18
    72
    72
      90
      90
```

11. bought 45 yards of Linen for 22 dollars 50 cents. what was the price of one yard: Ans. 50 cents

```
45)22:50(50
   22.5
```

12. If 25 men expend 15555 dollars 50 cents in the erection of a bridge. how much has each one to pay. if the shares are equal: Ans. 622d 22c.

```
25)15555.50(622d22c
   150
     55
     50
      55
      50
       55
       50
        50
        50
```

Having ~~gone through~~ ~~federal~~ treated of federal money separately. inasmuch as it requires to be well understood. Seeing it is the genave currency in the united States. We now proceed to the other parts of mixed numbers: or as they are frequently termed. divers denominations.

982703.56¾

Compound Addition add

Compound Addition

Troy Weight

1:

lb	oz	dwt	gr
	12	20	24
4	10	15	16
8	6	10	11
6	9	14	23
20	3	1	2
15	4	5	10
20	3	1	2

2

lb	oz	dwt	gr
	12	20	24
5	8	4	16
4	10	15	21
6	11	18	17
20	7	6	6
16	10	14	14
20	7		6

~~Troy Weight~~

English Money

1: mestacke

£	s	d
	20	12
1256	11	8
4462	8	4
3215	10	6
£ 13934	10	6

2

£	s	d	gr
	20	12	4
35678	11	4	1/2
37562	18	7	3/4
63497	15	10	1/4
136739	6	3	1/2
101060	14	6	0
136739	6	3	1/2

3:

£	s	d	gr
	20	12	4
2368	17	5	1/2
3964	19	11	1/4
9386	14	6	3/4
15725	11	11	1/2
13356	14	6	0
15725	11	11	1/2

Troy Weight

This weight is used for jewels. gold. silver. and liquors the denominations are. pounds. ounces. penny weights. and grains.

Thus valued

24 grains (gr) make 1 penny weight ... dwt

20 pennyweights — 1 ounce — oz

12 ounces — 1 pound £

3:

£	oz	dwt	gr
	12	20	24
4	5	17	11
9	6	12	9
18	11	19	23
33	0	9	19
28	6	12	8
33	0	9	19

Avvirdupois Weight. B 3

This weight is used for heavy articl's generally and all metals but gold and siver.

The denominations are. tons hundreds quarters. pounds ounces. and drams.

Thus valued.

16 drams. (dr) make	— —	1 ounce	— oz
16 ounces	— —	1 pound	— lb
28 pounds	— —	1 quarter	— qr
4 quarters (or 112 lb.)	— —	1 hundred	— cwt
20 hundreds	— —	1 ton	— t

examples.

1.

	20.	4.	28.	16.	16
t	cwt	qr	lb	oz	dr
10	16	2	24	9	12
15	11.	1	15	12	9
85	8	3	19	13	13
16	45	1	14	10	8
130	21	1	18	14	10
119	5	2	22	4	14
130	21	1	18	14	10

2.

	20	4	28	16	16
t	cwt	qr	lb	oz	dr
856	12	3	19.	11	10
537	19	1	23.	8	9
638	10	2	21.	12	6
887	19	3	27.	17.	15
2921	3	0	9	2.	8
2064	10	0	17	6.	14
2921	3	0	9	2	8

Compound Addition Book 1

Apothecaries' Weight.

Examples.

1:

℔	oz	dr	sc	gr
17	5	7	2	14
80	3	2	1	16
85	10	3	2	5
36	6	2	1	15
220	2	0	2	10
202	8	0	2	16
220	2	0	2	10

2:

℔	oz	dr	sc	gr
8	5	2	1	16
3	11	7	2	19
6	8	6	1	12
5	2	4	2	9
24	8	2	2	8
16	3	0	0	4
24	8	2	2	8

Cloth Measure: Cloth Measure: Clo-th Measure

Examples

yd	qr	na
56	2	2
86	1	3
33	3	2
35	2	1
215	2	0
155	3	2
215	2	0

e.fl	qr	na
50	2	3
18	1	2
36	2	2
36	2	1
172	1	0
91	2	1
172	1	0

e.fr	qr	na
16	4	2
17	5	1
80	2	2
18	3	3
130	0	0
112	3	2
130	0	0

e.en	qr	na
56	4	3
53	3	2
32	2	1
81	0	0
221	2	2
167	1	3
221	2	2

James McCormick His Book

Compound Addition Addition

Long Measure.

Examples.

	3	8	40	5½	3	12	3
deg	m	fur.	po.	yds	ft	in	bc
50	30	5	15	2	2	9	2
6	25	7	12	4	1	10	1
75	35	2	9	2	2	8	1
20	55	6	8	1	1	11	2
223	3	5	6	1	0	4	0
169	4	7	80	3½	0	6	1
223	3	5	6	1	0	4	0

	3	8	220	3	12
l.	m.	fur.	yds.	ft.	in.
5	2	6	115	2	11
3	1	4	95	1	9
2	1	3	15	2	8
1	2	5	200	1	6
13	2	3	167	2	10
7	2	5	91	2	11
13	2	3	167	2	10

Land Measure. Land Measure

Examples.

	4	40
A.	r.	p.
25	3	20
33	1	16
33	2	34
68	1	39
161	1	29
135	2	9
161	1	29

	4	40
a.	r	p
265	2	15
375	1	29
860	3	39
632	2	20
2134	2	23
1669	0	18
2134	2	23

	4	40
a.	r.	p.
246	3	29
762	1	12
632	2	11
357	3	20
1999	2	32
1752	3	3
1999	2	32

Compound Addition

Cubic, or solid Measure

Co	ft (1728)	in (1728)
4	112	1260
6	84	1500
8	127	1700
5	63	1103
23	388	1407
19	276	147
23	388	1407

t	ft (1728)	in (1728)
6	39	1384
2	26	526
8	18	260
3	12	1100
19	96	1542
13	57	158
19	96	1542

T	ft (1728)	in (1728)
23	12	1400
68	45	5100
82	49	1700
96	18	50
269	126	1294
246	113	1622
269	126	1294

Time

Examples

Y	mo (12)	d (7)	h (24)	mi (60)	sec (60)
22	10	25	16	34	55
34	6	16	20	48	33
46	9	23	23	59	59
104	10	3	13	23	27
81	8	5	20	48	32
104	10	3	13	23	27

Y	d (365)	h (24)	mi (60)	sec (60)
4	350	15	19	5
2	268	13	54	38
6	350	22	50	50
14	240	4	4	33
9	254	12	45	28
14	240	4	4	33

Compound Addition

Motion

Examples

sig	30 deg	60 mi	60 sec
2	24	48	58
2	29	59	59
3	31	20	20
9	16	9	17
6	21	20	19
9	16	9	17

[illegible]

sig	30 °	60 ′	60 ″
3	20	30	40
2	25	35	45
3	26	38	58
10	12	45	23
6	22	14	43
10	12	45	23

Liquid Measure. Examples

Examples

T	4 hhd	63 gal	2 qt	4 pt
4	3	53	2	1
6	2	23	3	1
8	1	62	1	1
20	0	17	0	3
15	0	26	0	2
20	0	17	0	3

T	4 hhd	63 gal
24	2	33
19	3	54
34	1	50
79	0	11
54	1	41
79	0	11

bu	4 p	8 qt
45	2	4
36	3	6
34	1	2
45	2	7
175	2	3
149	3	7
175	2	3

Dry Measure

bu	p	q
256	3	6
243	1	6
465	3	1
554	2	7
1543	3	4
1296	3	6
1553	3	4

bu	p	qt
34156	3	7
2003	1	2
950	0	6
4809	0	0
41920	0	7
7763	1	0
41920	0	7

Compound Subtraction

Examples

£	20 s	12 4 d qr
256	15	6½
129	12	8¾
127	2	4¾
256	15	6½

T	20 cwt	4 qr	28 lb	16 oz	16 dr
246	15	2	18	11	5
89	16	1	24	8	15
156	19	0	22	2	6
246	15	2	18	11	5

mi	8 fur	40 p	16½ ft	12 in	3 bc
250	4	24	10	6	1
125	6	30	5	10	2
124	5	34	4	7	2
250	4	24	10	6	1

bu	4 p	8 qt	2 pt
204	2	6	1
150	3	2	0
53	3	4	1
204	2	6	1

d	24 h	60 mi	60 sec
325	18	30	24
236	20	45	50
88	21	44	34
325	18	30	24

T	4 hhd	63 gal	8 qt	2 pt
50	2	45	2	1
20	3	60	3	0
29	2	47	7	1
50	2	15	2	1

Sig	30 Deg	60 mi	60 sec
6	16	32	29
3	24	16	48
2	22	15	41
6	16	32	29

A	4 R	30¼ P
16 58	2	16
12 49	3	34
4 08	2	12¼
16 58	2	16

Compound Multiplication

No. 5

No. 3 Application

£	20 s	12 d
2	6	4
		5
11	11	8

£	20 s	12 4 d qr
1	2	6¼
		9
10	2	8¼

20 s	12 4
12	9½
	11
7 0	8½

£	20 s	12 4 d qr
2	4	2½
		12
12) 26	10	6
2	4	2½

£	20 s	12 4 d qr
12	8	6¼
		3
3) 37	5	6¾
12	8	6½

by 18 = 3 × 6

228	13	4½
		8
8) 1789	7	2
223	13	4¼

1. Multiply 4 t. 3 cwt. 1 qr. 16 lb. 8 oz. 10 dr. by 36. Ans. 150 t. 2 cwt. 1 qr. 7 lb. 6 oz. 8 dr.

4	3	1	16	8	10
					6 × 6 = 36
25	0	1	15	3	12
					6
150	2	1	7	6	8

Compound Multiplication

2: 120l. 6s. 9d. by 24. Ans. 2888l. 2s. 0d.

£	20 s	12 d
120	6	9
		6 × 4 = 24
722	0	6
		4
2888	2	0

3: 24t. 4cwt 2qr. 7lb. by 48.
Ans. 1162t 19cwt. 0qr. 0lb.

24	4	2	7
			8 × 6 = 48
193	16	2	0
			6
1162	19	0	0

Multiply 12 b. 2 pec. 4 qt by 17

b.	pec.	qt	
12	2	4	by 17
		4 × 4 + 1 = 17	
50	2	0	
		4	
202	0	0	= 16
12	2	4	= 1
			17
214	2	4	

Multiply 8d. 4h. 12mi. 5sec. by 29.
Ans. 237d. 1h. 50mi. 25 sec

D 24 h 60 mi 60 sec
8 : 4 : 12 : 5 × 1
4 × 7 × 1 = 29

32 . 16 . 48 . 20
7
228 . 21 . 38 . 20
5
8 . 4 . 12 . 5
237 1 50 25

Compound Multiplication

s	d	
2	6	by 245
	10×5	
15	0	
	10	×4
12 10	0	
	2	
25 0	0	
5 0	0	
12	6	
30 12	6	

s	d	
14	6	by 240
	10×0	
7 5	0	×4
	10	
72 10	0	
	2	
145 0	0	
29 0	0	
0	0	
174 0	0	

£	s	d	
1	2	3	by 117
		10	
11	2	6	
		10	
111	5	0	
		1	
111	5	0	
11	2	6	
7	15	9	
130	3	3	

£	s	d	
1	2	6	by 275
		10×5	
11	5	0	×7
		10	
112	10	0	
		2	
225	0	0	
78	5	0	
5	12	6	
309	7	6	

130 . . 3 . . 3
20
2603
12 | 12
117) 31239 (267 | 267
234 | 20 | 22 | 2 — 3
783 | 1 . . 2 . . 3
702
819
819

James McCormick

James McCormick

Compound Division B

	£	s	d qr
2)	465	10	6 ½
	232	15	3 ¼
	465	10	6 ½

	T	cwt	qr	lb
6)	91	16	1	14
	15	6	0	5/6
	91	16	1	14

	T	hhd.	gal.	qt
8)	468	1	48	3
	58	2	13	3/8 = 7
	468	1	48	3

	£	s	d qr
3)	563	15	4 ½
	187	18	5 ½ 3
	563	15	4 ½

	yds	ft	in
5)	960	1	9
	192	0	4=1 5
	960	1	9

	w 7	d 24	h 60	mi 60	sec
10)	30	6	18	48	50
	3	0	16	16	53
	30	6	18	48	50

examples

	£	s	d	
6)	224	12	6	by 30 = 6 × 5
5)	37	8	9	
	7	9	9 5	
	37	8	9 6	
	224	12	6	

	£	s	d	
11)	134	18	8	by 44 = 11 × 4
4)	12	5	4	
	3	1	4	

	£	s	d	
12)	984	0	0	by 144 = 12 × 12
12)	82	0	0	
	6	16	8	

9)	474	0	0	by 72 = 9 × 8
8)	52	13	4	
	6	11	8	

Compound Division

7. A goldsmith bought 11 ingots of silver each of which weighed 4 lb. 10 oz. 15 dwt. 22 gr. how much is the whole weight.

Ans. 45 lb. 7 oz. 15 dwt. 2 gr.

lb	12 oz	20 dwt	24 gr
4	1	15	22
			11
45	7	15	2

8. A innkeeper bought four loads of hay. weighing as follows. viz. first load. 18 hundred 2 quarters and 14 lb. second load. 16 hundred. 3 quarters 18 lb. third load. 22 hundred and 24 lb. fourth load. 24 hundred and 1 quarter: how much hay in all.

Ans. 4 tons 2 hundred

	Cwt	Qr	lb
1 =	18	2	14
2 =	16	3	18
3 =	22	0	24
4 =	24	1	00
4 =	2	0	00

9. Bought 8 loads of hay. each load weighing 1 ton 2 hundred 3 quarters 16 lb. how much hay in all.

Ans. 9 tons 3 hun. 16 lb.

T	20 cwt	4 qr	28 lb
1	2	3	16
			8
9 ..	3 ..	0 ..	16

10 Divide 9 ton 3 hundred 16 lb. into eight shares.

~~[illegible]~~

Ans. 1 ton 2 hun. 3 qr. 16 lb.

	T	Cwt	qr	lb
8)	9 ..	3 ..	0 ..	16
	1 ..	2 ..	3 ..	16

11 Bought 15 tracts of land. each containing 3 hundred acres 2 roods and 20 perches: what is the amount of the whole. Ans. 4509 acres 1 qr. 20 rods

	A	4 R	40 P
	300	2	20
			5
	1503	0	20
			3
5	4509	1	20
3)	901	3	20
	300	2	20

Compound Division

12. Divide a tract of land containing 4509 acres 1 rood and 20 perches equally among 15 persons; what is each one's share:

Ans. 300 acres 2 roods 20 perches.

5) 4509 . 1 . 20
3) 901 3 20

300 2 20
5
1503 0 20
3
4509 1 20

13. Bought 179 bushels of whe at for 201 dollars 34½ cents: what is it per bushel;

Ans 1 doll 12 cts

Bush
179) 201 : 34½ (1 . 12½ Ans
179
223
179
447
358
89
4
358
358

14. if a man spend 7 pence per day: how much will it amount to in year: Ans. 10l 12s. 11d.

£	S	D
0	0	7
		10
0	5	10
		10
2	18	4
		3
8	15	0
1	15	0
0	2	11
10	12	11

15. What is the value of 1000 bushels of coal at 10½ cents per bushel; Ans. 105 dolls.

½ 1000
10½
10000
500
105:00

Compound Division

16. Bought 135 gllons of bran dy at 1 dollar and 62½ cents per ga lon: required the prime cost what it was sold for: and the gain: Ans. prime cost 219 dolls. 37½ cts: sold for 276 dolls. 75 cts gain 57 dolls. 37½ cts.

```
      1 . 35
      1   62½
      2   70
     81   0
    135
          67½
   219 . 37½

        2 . 05
        1 . 35
       10   25
       61   5
      205
      276   75
      219   37½
       57 . 37½
```

17: if 27 Cwt. of sugar cost 47l. 12s. 10½d. what cost 1 Cwt: Ans. 1l. 15s. 3½d.

```
      L    S    D
   9)47 = 12 = 10½
   3) 5    5   10½
      1   15    3½

27)47 = 12 = 10½(1 = 15 3½
   27
   20
   20
   412
   271
   142
   135
     7
    12
    84
    81
    13
     4
    54
```

18. Suppose a man has an esta te of 9708 dollars. which he divides among his fav sons: to his eldest he gives 2/5 and to the other three an equal share each of the remain. der: what is the share of each:

Ans. eldest son. 3883 dolls 20 cents. other sons. each 1941 dolls. 60 cents.

```
      9708
         2
   5)19416
     3883 = 20

   5)9708
     1941 = 60
```

Reduction Reduction

1. Reduce 100 cents to pence.

```
10)100 cents
    10
    90 pence. Ans.
```

2. Reduce 90 pence to cents

```
9)90 pence
   10
  100 cents. Ans.
```

3. Reduce 125 l. 10 s. 6½ d. to farthings.

```
 125 l. 10 s. 6½ d.
  20
 2510 shillings
   12
 30126 pence
    4
120506 farthings Ans.
```

4. Reduce 120506 farthings to pounds.

Ans. 125 l. 10 s. 6½ d.

```
 4)120506 farthings
12|30126½
20|2510 .. 6
   125 .. 10 .. 6½
    20
  2510
    12
 30126
     4
120506
```

5. Reduce 260 cents to pence.

Ans. 234 d.

```
 260
  26
 234
```

6. Reduce 480 l. 19 s. 9 d. to cents.

```
  £    S   d
 480 .. 19 .. 9
  20
 9619
   12
9)115437
  12826  3/9 = 1/3
  128263      1/3
```

7. Reduce 4658 pence to pounds.

Ans. 19 l. 8 s. 2 d.

```
12)4658
20) 388 = 2
     19 = 8 = 2
```

8. Reduce 648 pence to cents.

Ans. 720 cents.

```
9)648
   72
  720
```

Reduction Reduction

9. Reduce 720 cents to pence.
Ans. 648 pence.

10)720
72
648

10. Reduce 24235 half-pence to pounds.
Ans. 50l. 9s. 9½d.

2)24235
12)12117 = ½
20)1009 = 9
50 = 9 = 9½

11. How many pounds. pennsylvania currency. in 216 french crowns:
Ans. 89l. 2s.

216
99
1944
1944
12)21384
20)1782
89 = 2

12. in 24l. 17s. how many cents and dollars:
Ans. 7960 cents — 79 dolls. 60cts.

£ s
24 „ 17
20
497
12
9)7164
796
100)7960
79 = 60

79 (60

13. in 375l. pennsylvania currency. how many dollars:
Ans. 1000 dolls.

£
375
20
7500
12
9)90000
10000
1000(00

Troy Weight

1. Reduce 115200 grains to pounds.
Ans. 20lb.

gr
24)115200
20)4800
12)240
20

2. Reduce 30lb. to grains.
Ans. 172800gr.

£
30
24
720
20
14400
12
172800

Reduction Reduction

3. Reduce 45645 penny weights to ounces. Ans. 2282 oz. 5 dwt.

20)4564|5
2282 = 5

4. Reduce 4 lb. 5 oz. 15 dwt 20 gr. to grains. Ans. 27260 gr.

lb	oz	dwt	gr
4	5	15	20
12			

56
20
1135
24
27260

5. Reduce 27260 grains to pounds. Ans. 4 lb. 5 oz. 15 dwt. 20 gr.

24)27260
20)1135 = 11
12)56 = 15
4 = 5 = 15 = 11

6. In 24 spoons each weighing 8 dwt. 6 gr. how many grains. Ans 4752 gr.

dwt	gr
8	6

24
198
24
792
396
4752

Avoirdupois Weight

1. Reduce 3 tons to pounds. Ans. 6720 lb.

3
20
60
4
240
28
1920
480
6720

2. Reduce 2867200 drams to tons. Ans. 5 tons.

16)2867200
16)179200
28)11200
[illegible]
4)400
20)100
5

3. Reduce 5 tons to drams.

Ans 2867200 dr.

5
16
80
16
1280
28
35840
4
143360
20
2867200

Reduction Reduction

4. In 6 barrels of flour each weighing 1cwt. 3qr. how many pounds.

Ans. 1176lb.

```
   1 = 3
   4
   7
  28
 196
   6
1176
```

5. In 16 cwt. 2qr. 14lb. how many pounds: Ans. 1862lb.

```
cwt  qr  lb
16   2   14
 4
66
28
532
133
1862
```

6. In a load of hay weighing 2876lb. how many hun-dreds.

Ans. 25cwt. 2qr. 20lb.

```
    lb
28) 2876
 4)  102 = 20
 2(0)  25 = 2
       15 = 2 = 20
```

Apothecaries Weight

1. Reduce 15lb. to scruples.

Ans. 4320sc.

```
  15
   3
  45
   8
 360
  12
4320
```

2. In a bottle containing 3lb. of calomel. how many grains:

Ans. 17280gr.

```
   lb
    3
   20
   60
    3
  180
    8
 1440
   12
17280
```

3. In 2½lb. of drugs. how many parcels. each 16 drams:

Ans. 15 parcels.

```
      lb   oz
       2 .. 6
      12
      30
       8
16) 240 (15
    16
     80
     80
```

4. In 576000 grains. how many pounds:

Ans. 100lb.

Reduction Reduction

2)(6)57600(0
3) 28800
8) 9600
12) 1200
100

Cloth Measure Cloth Measure

1. Reduce 250 yards to nails.
Ans. 4000 nails.

250
4
1000
4
4000

2. In 8642 nails how many Ells English:
Ans. 432 Ells E. 2 nails.

5)8642
4)1728 . 2
432 . 2

3. In 324 Ells french how many yards:
Ans. 486 yds.

324
6
4)1944
486

4. In 16 bales of cloth. each measuring 36 Ells flemish. how many yards:
Ans. 432 yds.

36
16
216
36
576
3
4)1728
432

Long Measure Long Measure
Long Measure

1. Reduce 260 miles to inches.
Ans. 16473600 inches.

260
8
2080
40
83200
5½
416000
41600
457600
3
1372800
12
16473600

2. Redce 11 miles 7 furlongs 38 perches 2 yards 2 feet. to barleycorns. Ans. 2280060 b.c.

m. fur p yds ft
11 7 38 2 2
8
95
40
3838
5½
19192
1919
21111
3
63335
12
760020
3
2280060

Reduction Reduction

3. Reduce 1267200 feet to geographical degees.
Ans. 4 degrees.

```
    3)1267200
220)  422400(1920
      220
      2024
      1980
       440
       440

  8)1920
 60) 240(4
     240
```

4. Reduce 3 leagues 2 furlongs 110 yards 1 foot 5 inches. to inches.
Ans. 590057 inches.

```
 l   fur yds ft in
 3   2   110  1  5
 3
 9
 8
 74
 220
 1590
 148
 16395
 3
 49187
 12
 590057
```

5. How many inches will reach round the world. at 60 miles to a degree: Ans. 1368576000 inches.

```
    360 deg
     60
  21600
      8        m
 172800 fur
    220
 3456000
 345600
 38016000 yds
       3   ft
 114048000 in
      12
 1368576000
```

Land Measure.

1. Reduce 25 acre to perches.
Ans. 4000 perches.

```
  25
   4
 100
  40
 4000
```

2. Reduce 176000 perches to acres.
Ans. 1100 acres.

```
4|0)17600|0
     4400
     1100
```

3. A tract of land containing 640000 perches is to be divided in to 400 equal shares how many acres will be in each share: Ans. 10 acres.

```
400)6400(10
    1600
    160
```

Reduction James M^c

4 In 10 acres how many square inches: Ans. 62726400 inches.

```
        10
         4
        40
        40
      1600
      30 1/4
     48000
       400
     48400
         9
    435600
       144
   1742400
  1742400
  435600
  62726400
```

Cubic or solid Measure

1 Reduce 3200 feet of wood to cords. Ans. 25 cords.

```
128)3200(25
    256
     640
     640
```

2 In 20 tons of square timber how many feet: Ans. 1000 feet.

```
   20
   50
 1000
```

3 In 30 tons of ~~square~~ round timber how many inches: Ans. 2073600 inches.

```
      30
      40
    1200
    1728
    9600
   2400
   8400
  1200
 2073600
```

4 In a grindstone 48 inches diameter and 6 inches thick: how many feet:

```
     48 diameter
     24 half do.
     72
     24
    288
   144
   1728
      6
1728)10368(6 cubic feet. Ans
     10368
```

5 In a mill-stone 4 feet 6 inches diameter and averaging 18 inches in thickness. how many cubick feet

```
        54
        27
        81
        27
       567
      162
      2187
        18
     17496
     2187
1728)39366(22 feet 1350 inches. Ans.
     3456
      4806
      3456
      1350
```

Reduction Reduction

Times Time

1. Reduce 8 Weeks 2 days 6 hours 20 minutes. to min-utes.
Ans. 83900 min

```
  W  d  h  mi
  8  2  6  20
  7
 58
 24
238
116
1398
  60
83900
```

2. Reduce 10 years to seconds.
Ans. 315576000 sec.

```
 365 - 6
  24
 1466
 730
 8766
   10
 87660
    60
 5259600
      60
315576000
```

4 How many seconds in one week.
Ans. 604800 sec.

```
   7
  24
  28
 14
 168
  60
10080
   60
604800
```

Liquid Measure.

1 Reduce 4 tuns to pints. Ans 8064 pints.

```
   4
   4
  16
  63
  48
 96
1008
   4
4032
   2
8064
```

2. Reduce 4032 pints to hogsheads. Ans. 8 hhd.

```
2)4032
4)2016
63) 504(8
    504
```

3. Reduce 38 hogsheads to pints. Ans 19152 pints

```
  38
  63
 114
228
2394
   4
9576
   2
19152
```

1. Reduce 75 bushels 2 pecks 4 quarts to pints. Ans. [illegible] pints

Dry Measure Dry Measure

1 Reduce 78 bushels 3 pecks 7 quarts to pints. Ans. 5054 pints.

```
bu   p   qr
78 = 3 = 7
 4
315
  8
2527
   2
5054
```

2. Reduce 2196 pints to bushels.
Ans. 34 bu. 1 pe. 2 qt

```
2)2196
8)1098
4) 137=2
    34=1=2
```

Of Decimal Arithmetick

Addition of Decimals

James

Examples Examples Examples

1:

```
 2468·5036
  521·0418
   32·0004
 ---------
 3021·5458
```

2:

```
 3460000·0000643
   46000·0000643
    3400·2680005
 ---------------
 3923400·3687078
 ---------------
  463460·3690435
 ---------------
 3923460·3687078
```

3. Add 283·604 + 490006·003275 + 21·05 1·2 + 6200·3476.
Ans. 496512·204875.

```
   283·604
490006·003275
    21·05
     1·2
  6200·3476
-------------
496512·204875
```

4. Add one hundred and twenty-five and five-tenths. + ten thousands and five millionths. + fifteen and seventy-two thousandths + two and one-hundredth.

Ans. 10142·582005.

```
  125·5
10000·000005
   15·072
    2·01
------------
10142·582005
```

Section 2.

Subtraction of Decimals

1. From 6432·50437
Take 369·95429
Rem 6062·55008

2: 848·045000
162·459364
685·585636
848·045000

3: 15·6547
7·3500
8·3047
15·6547

4. From 45·005 Take 23·65482
Ans. 21·35018.

45·00500
23·65482
21·45018

5. From six hundred and twenty and two-tenths take two hundred and two thousandths.
Ans. 420·198.

620·200
200·002
420·198

Section 3.

Multiplication of Decimals

Multiply 29·831
1. by ·952
59662
149155
268479
28·399112

2. 24·021
4·23
72063
48042
96084
101·60883

3. 22·2043
12345
1110215
888172
666129
444086
222043
274112·0835

4. Multiply ·385746
00463
1157238
2314476
1542984
0000000
0000000
·0017860038

5: 158·694
23·15
793470
158694
476082
317388
3673·76610

6: 024653
000022

049306
049306
00000542366

Division of Decimals

Examples

1.

```
29.831)28.399112(.952
       26 8479
        1 55121
        1 49155
          59662
          59662
```

2.

```
24.021)101.60883(4.23
        96 084
         5 5248
         4 8042
           72063
           72063
```

3.

```
23.7)65321(2756.16+
     474
     1792
     1659
      1331
      1185
       1460
       1422
         380
         237
        1430
        1422
           8
```

```
   20
3.20
   12
2.40
    4
1.60
```

4.

```
64.25)234.70525(3.653
      192 75
       41 955
       38 550
        3 4052
        3 2125
          19275
          19275
```

5.

```
3)10(3.3333+
  9
  10
   9
  10
   9
  10
   9
  10
   9
   1
```

6.

```
9)9(10
  9
```

9.

```
.00463).00178600398(385746
        1389
         3970
         3704
          2660
          2315
           3453
           3241
            2129
            1852
             2778
             2778
```

Section 5.

Reduction of Decimals

1. Reduce $\frac{1}{4}$ to a decimal.

4)100 minu
25 Deno

2. Reduce $\frac{1}{2}$ to a decimal.

2)10
5

3. Reduce $\frac{3}{4}$ to a decimal.

4)300
75

4. Reduce $\frac{7}{8}$ to a decimal.

8)7000
875

5. Reduce $\frac{1}{25}$ to a decimal.

25)100
04

6. Reduce $\frac{57}{60}$ to a decimal.

A 60)570
95

7. Reduce $\frac{6}{15}$ of a dollar to cents.

15)6.00
.40

3 Examples 7 Example 3

1. Reduce 17s. $8\frac{3}{4}$d. to the decimal of a pound

4|3
12|8.75
20|17.7291666 + Ans
.8864583

2. Reduce 19s. to the decimal of a pound

20|19
95

3. Reduce 3d. to the decimal of a shilling.

12|3
.25

4. Reduce 3d. to the decimal of a pound.

12|3
20|25
.0125

5. Reduce 4cwt. 2qr. to the decimal of a ton.

4|2
20|4.5
225

6. Reduce 2qr. 14lb. to the decimal of a cwt.

28|14
4|2.5
.625

7. Reduce 3qr. 3na. to the decimal of a yard.

4|3
4|3.75
.9375

1. Reduce .8864583 of a pound to its equivalent value in integers.

8864583
20
17.7291660
12
8.7499920
4
2.9999680

2. What is the value of .75 of a pound: Ans. 15s.

75
20
15.00

3. What is the value of .70 of a pound troy: Ans. 8oz. 8dwt.

7
12
8.4
20
8.0

Reduction of Decimals

4. what is the value of ·617 of a cwt: Ans. 2qr. 13lb. 10oz. 10+dr.

617
4
2·468
28
3744
936
13·104
16
624
104
1·664
16
3984
664
10·624

5. what is the value of ·3375 of an acre: Ans. 1 rood 14 per.

3375
4
1·3500
40
14·0000

6. what is the value of ·258 of a tun of wine: Ans. 1 hhd. 2 + gl

258
4
1·032
63
096
192
2·016

7. what is the proper quantity of ·761 of a day: Ans. 18h. 15 mi. 50·4 sec.

761
24
3044
1522
18·264
60
15·840
60
50·400

~~8. what is the proper quantity of ·3 of a year: Ans. 109d. 12h.~~

8. whais the proper quantity of ·7 of a lb. of silver: Ans. 8oz. 8dwt.

7
12
8·4
20
8·0

9 what is the proper quantity of ·3 of a year: Ans. 109. 12h.

365
3
109·5
24
12·6

10 what is the difference between ·41 of a day and ·16 of an hour: Ans. 9h. 40 mi. 48 sec.

41
24
164
82
9·84
60
50·40
60
24·00

16
60
9·60
60
36·00

h m s
9 .. 50 .. 24
0 .. 9 .. 36
9 .. 40 .. 48

11. what is the sum of ·17T. ·19cwt. ·14qr. and ·7lb. Ans. 3cwt. 2qr. 15. 54lb.

T cwt qr lb
17 .. 19 .. 14 .. 7
3·54
4
2·53
28
431
106
14·91

14·91 91
3.2 28
364 728
28 182
2·548

The Single Rule

1. 8 yards of cloth at 32 dollars. What will 24 yards cost:

yds. D yds
8 : 32 :: 24 proof. as 96 : 24 :: 32
24
128
64
8)768
96 Ans

2. When sugar is sold at 12 dollars 32 cents per cwt. What will 16 lb. cost.
Ans. 1 doll. 76 cts.

lb D lb
112 :: 12.32 : 16
16
112)19712(176
112
851
784
672
672

3. What is the amount of 3 cwt. of coffee at 36 cents per pound.
Ans. 120 doll. 96 cts.

lb C cwt
1 :: 36 : 3
336
216
108
108
120.96

4. What will 4 pieces of linen come to, containing 23. 24. 25. and 27 yards, at 72 cents per yard.

23
24
25
27
99

yds cents yds
1 :: 72 : 99
99
648
648
71.28

5. What will 4 cwt. 2 qr 8 lb. of iron come to at 48 cents for 4 lb.
Ans. 61 dolls. 44 cts.

lb cwt q lb
4 :: 48 . 4 . 2 . 8
4
18
28
152
36
512
48
4096
2048
4)24576
61.44

6. What will 128 lb. of pork come to at 8 cts. per pound.
Ans. 10 dolls. 24 cts.

lb cts lb
128 :: 8 : 128
128
64
16
128)1024(8
1024

# of Three Direct by J. McCormick

7. If 9½ dozen pair of stockings cost 68 dollars 40 cts. what will 3 pair cost: Ans. 1 doll 80 cts.

Stockings

9.5
12
Pair 114 :: 68,40 : 3
3
114)205.20(1.80
114
912
912

8. If 20 bushels of oats cost 9 dollars 60 cents what will 3 bushels come to: Ans. 1 doll. 44 cts.

bu $ bu
20 :: 9,60 : 3
3
20)2880(1.44
20
88
80
80
80

8. A merchant bought a piece of cloth for 16 dollars 50 cents, at 76 cents per yard; how many yards were there in the piece:

Ans. 22 yds.

$ C yds $ C
16,50 :: 22 : 16,50
1650
1100
132
22
16,50)36300(22
3300
3300
3300

10. If 17 cwt. 3 qr. 17 lb. of sugar cost 320 dollars 80 cts. what must be paid for 6 oz: Ans. 6 cents.

cwt qr lb $ C oz
17 :: 3 17 :: 320,80 : 6
4 6
71 192480
28
575
143
2005)2005
16
12030
2005
32080)192480(6 Ans
192480

11. If 9,7 lb. of silver is worth 97 dollars what is the value of 1,5 oz

Ans. 1 doll. 25 cts.

lb $ oz
9,7 :: 97 : 1,5
1,5
485
97
116,4)145,5(1,25
1164
2910
2328
5820
5820

12. If 125,5 acres sold for 627,5 dollars; what will 4.75 acres cost:

Ans. 23 dolls. 75 cts.

Acrs $ Acrs
125,5 :: 627,5 : 4.75
475
31375
43925
25100
125500)2980625(23,75
251000
470625
376500
941250
878500
627500
627500

Contined Continued

13. If 1,5 gallons of wine cost 4 dollars 50 cents. what will 1,5 tuns cost:
Ans. 1134 dolls.

gal	DC	G
1.5 ::	4,50 :	1.5

4,50 × 3780 = 1701000
1,5 × 4 = 60 ; 63 × 60 = 3780

1.5)1701000(1134,00
15
20
15
51
45
60
60
00

14. How many reams of paper at 1 dollar 66 cents. 1 dollar 97 cents. and 2 dollars 31 cents per ream may be purchased for 528 dollars 66 cents of each an equal number.
Ans. 89 reams of each sort.

C : 166 + 197 + 231 = 594 :: R 1 :: DC 528,66

594)52866(89
4752
5346
5346

15. when iron is sold for 224 dollars per ton, what will 1 qr. 14 lb. cost: Ans. 4 dolls. 20 cts.

T : D :: qr : lb
1 : 224 :: 1 : 14
20 × 20 = ... 4 → 80 × 28 = 2240
1 × 28 + 14 = 42 × 224 = 9408

2240)9408(4.20
8960
4480
4480

16. A merchant paid 1402 dollars 50 cents for flour, at 5 dollars 50 cents per barrel: how many barrels must he receive.
Ans. 255 barrels.

DC : B :: DC
5,50 : 1 :: 1402,50

5,50)140250(255
1100
3025
2750
2750
2750

17. A man has a yearly salary of 1186 dollars 25 cents. how much is it per day: Ans. 3 dolls 25 cts.

Days : DC :: year
365 : 1186,25 :: 1

365)118625(3,25
1095
912
730
1825
1825

Continued in September by J. C.

18. A man spends 2 dollars 25 cents per day, and saves 378 dollars 75 cents at the end of the year. what is his yearly salary:

Ans. 1200 dolls.

As days 1 : C 2,25 :: D 365
225
1825
730
730
82125
37875
120000

19. What will 4 t. 10 cwt. 1 qr 12 lb. of hay come to at 1 dollar 12 cents per cwt.: Ans. 101 dolls. 20 cts.

hun 1 : C 1,12 :: D 4 . 10 . 1 . 12
4
4
28
112
90
4
361
28
2900
722
10120
112
20240
10120
10120
112)1133440(101,20
112
134
112
224
224
0

20. how much will a grind stone 4 feet 6 inches diameter, and 9 inches thick, come to at 1 dollar 10 cents per cubic foot: Ans. 12 dolls. 53 cts.

ft 4 : in 6 : in 9
12
54
27
81
27
567
162
2187
9
1728 :: 110 : 19683
110
196830
19683
1728)2165130(12,53
1728
4371
3456
9153
8640
5130
5184

21. What will a grindstone 28 inches diameter, and 3,5 inches thick, come to at 1 dollar 90 cents per cubic foot: Ans. 2 dolls. 26 cts:

in 28 : in 3,5
14
42
14
138
42
588
35
2940
1764
In 1728 : D C 1,90 : 20580
190
1852200
20580
1728)3910200(226
3456
4542
3456
10860
10368
492

Single Rule

22. At 22l. 8s. per ton. what will 203t. 3qurt. 3qr. 8lb. of tobacco come to: Ans. 4558. 3s.

23. If 850 dolls. 50 cents is paid for 18 pieces of cloth at the rate of 11 dollars 25 cents for 5 yards. how many yards were in each piece. allowing a equal number to each piece: Ans. 21 yds.

11,25 : 5 : : 850,50

18)378(21 Ans

24. If 12½ yards of muslin cost 1l. 17s. 6d. what is it per yard: Ans. 3s.

Yds £ S d yard
12.5 : 1 : 17 : : 6 : 1.0

(12)36
3 Ans

25. If a staff 4 feet long cast a shadow on level ground 7 feet long. what is the height of a steeple whose shade at te same time is 218 feet 9 inches: Ans. 125 feet.

ft ft ft in
7 : 4 : : 218 : 9

84)10500(125

Continued

26. If 4292 dollars 32½ cents are paid for 476 acres 3 roods 28 perches of land. how much is it per acre:

A R P : D C : A
476.3.28 : 4292,325 :: 1

1907 / 40 / 76308

Ans.

27. If a man's anual income be 1333 dollars. and he expend daily 2 dollars and 14 cents, how much will he save at the end of the year.

Ans. 551 dolls. 90 cts.

D : DC :: D
1 : 2,14 :: 365

1333,00
781.10
551,90

28. If 321 bushels of wheat cost 240 dollars 75 cents. what is it per bushel: Ans. 75 cts.

Bu : DC :: Bu
321 : 240,75 :: 1

321) 24075 (75
2247
1605
1605

29. If 1½ yard of cloth cost 2 dollars 50 cents. what will 1 quarter 2 nails come to: Ans. 62½ cts.

yard : DC :: qr. na
1½ : 250 :: 1.2

24) 1500 (62½

30. Bought 3 pipes of wine containing 120½, 124, and 126¾ gallons, at 5s. 6d. per gallon: what do they cost:

Ans. 102 l. 1s. 10½ d.

gal : DC :: gal
1 : 5.6 :: 120½

12) 2041=10
20) 102=1=10½

The Single Rule

The Single Rule

31. A sets out from a certain place and goes 12 miles a day: 5 days after B sets out from the same place, the same way, and goes 16 miles a day; in how many days will he overtake A? Ans. 15 days.

M : D :: M
4 : 1 :: 60
1
60
15

32. If I have owing to me 1000l. and compound with my debtor, at 12s. 6d. per pound, how much must I receive? Ans. 625l.

£ : S D :: £
1 : 12 - 6 :: 1000
12 150
150 12)150000
2(0)1250
625

33. If 365 men consume 75 barrels of pork in 9 months, how many will 500 men consume in the same time? Ans. $102\frac{54}{73}$ barrels.

Men : barls :: Men
365 : 75 :: 500
500
365)37500(102
365
1000
730
5)270 | 54
365 | 73

34. How much land at 2 dollars 50 cents per acre, must be given in exchange for 360 acres, at 3 dollars 75 cents? Ans. 540 acres.

DC : A :: DC
2.50 : 360 :: 3.75
360
22500
1125
250)135000(540
1250
1000
1000
0

35. If the earth, which is 360 degrees in circumference, turns round on its axis in 24 hours, how far are the inhabitants at the equator carried in one minute, a degree there being $69\frac{1}{2}$ miles? Ans. 17 miles 3 fur.

H : Deg :: Mi
24 : 360 :: 1
60 69.5
1440 1800
3240
2160
1440)25020 0(17.3
1440
10620
10080
540
8
1440)4320(3
4320

The Single Rule of Three Inverse

1. If 20 men can build a wall in 12 days. how long will it require 40 men to build the same:

M D M Ans
Ans 20 : 12 :: 40 proof. Ds 6 : 40 :: 12
12 40
40)240(6 days. Ans. 12)240(20 men.
240 24
0

2. If 60 men can build a bridge in 100 days, how long will it require 20 men to build it:

Ans 300 days.

M D M Days
60 100 :: 20 300
100 20
20)6000(300 100)6000(60
6 600
00 0

3. If a wall 100 yards long requires 65 men 4 days. In what time would 5 men complete it:

Ans. 52 days.

M D M D
65 : 4 :: 5 : 52
4 5
5)260(52 Ans 4)260(65
25 24
10 20
10 20

4. If a barrel of flour will last a family of 6 persons 24 days. how long would it last if 3 more were added to the family: Ans. 16 days.

Persons Ds Persons
6 : 24 :: 9
6
9)144
16

5. If 5 dollars is paid for the carriage of 1 cwt. weight 150 miles. how far may 6 cwt. weight be carried for the same money:

Ans. 25 miles.

cwt M cwt
1 : 150 :: 6
1
6)150
25

6. If a street 80 feet wide and 300 yards long, can be paved by 40 men in 20 days, what length will one of 60 feet wide, be paved by the same men in the same time: Ans. 400 yards.

ft yards ft
80 : 300 :: 60
300
60)24000(400
240
00

7. If a field that is 80 rods wide and 30 in length contain 15 acres. how wide must one be, to contain the same quantity, that is but 70 rods long:

Ans. 34 rds. 4 ft. 8 4/7 in.

length R length
80 : 30 :: 70
30
70)2400(34 .. 4 .. 8 4/7
210
300
280
20
16 1/2
330
10
330 4 ft
280
50
12
600 8 4/7 in
560
40

8. If a board be ,75 of a foot wide what length must it be to measure 12 square feet: Ans. 16 feet.

ft : ft :: ft
1 : 12 :: ,75

,75)1200(16
75
450
450

9. How much cloth 1,25 quarters wide can be lined by 42,5 yards of silk that is ,75 of a yard wide:

Ans. 25,5 yards.

yds : yds :: qr
,75 : 42,5 :: 1,25

1,250)31875(25,5
2500
6875
6250
6250
6250

10. If 10 men could complete a building in 4,5 months what time would it require if 5 more were employed: Ans. 3 months.

men : men :: men
10 : 4,5 :: 15

15)450(3
45

11. In what time will 600 dollars gain 50 dollars when 80 dollars would gain it in 15 years: Ans. 2 years.

D : yards :: D
80 : 15 :: 600

600)1200(2 years
1200

12. If a traveller can perform a journey in 4 days when the days are 12 hours long what time will he require when the days are 16 hours long: Ans. 3 days.

h : D :: h
12 : 4 :: 16

16)48(3 days
48

13. Suppose 400 men in a garrison are supplied with provisions for 30 days how many men must be sent out if they would have the provisions last 50 days: Ans. 160 men.

D : M :: D
30 : 400 :: 50

50)12000(240
100
200
200
0

400
240
160 men

Single Rule of Three Direct

14. Lent a friend 292 dollars for 6 moths: afterwards I borrow from him 806 dollars: how long may I keep it to balance the favor:

Ans. 2 months 5 days.

D : M : D
292 : 6 :: 806
6
806) 1752 (2 Months
1612
140
30
806) 4200 (5 days
4030
2) 170 = 85
806 = 403

16. If a piece of land 40 rods in length and 4 in breadth make an acre. how wide must it be if it is but 25 rods long: Ans. 6 2/5 rodes.

R : R : R
4 : 40 :: 25
4
25) 160 (6 2/5 rods
150
5) 10 = 2
25 = 5

17. How much in length that is 3 inch is bread will make a square foot:

Ans. 48 inches.

in : in : in
12 : 12 :: 3
12
3) 144
48 in

15. 1200 men stationd in a garrison have provisions for 9 months at the rate of 14 ounces per day: how long at the same allowance will the same provisions last if they are reinforced by 400 men: And also what diminution must be made on each ration, that the provisions may last for the same time: Ans. 6 3/4 months at the same allowance — 3 1/2 oz. deduction to last for the same time.

Men : M : Men
1200 : 9 :: 1600
9
1600) 10800 (6 3/4 Months
9600
4) 1200 (3/4
1600
Men : oz : Men
1200 : 14 :: 1600
14
1600) 16800 (10 1/2
1600
3 1/2 oz
800 = 1
8) 1600 = 2

18. If a pasture field will feed 6 cows 91 days. how long will it feed 21 cows:

Ans. 26 days.

cows : days : cows
6 : 91 :: 21
6
21) 546 (26
42
126
126

19. There is a cistern having 1 pipe. which will empty it in 10 hours; how many pipes of the same capacity will empty it in 24 minutes:

Ans. 25 pipes.

H : P : Mi
10 : 1 :: 24
60
600
1
24) 600 (25
48
120
120

Single Rule of Three Inverse

20. How many yards of carpeting that is half a yard wide. will cover a floor that is 30 feet long and 18 feet wide: Ans. 120 yards.

ft ft ft
300 : 18 : : 1.5
300
1.5)5400(3)360
45 120 yards Ans
90
90
0

21. What is the weight of a peace to a steel yard, which being suspended 39 inches from the centre of motion. will equipoise 208 lb. suspended at the draught end 3/4 of an inch: Ans. 4 lb.

in lb in
3/4 : 208 : : 39
.75
1040
1456
3900)156.00(4
15600
0

22. A and B depart from the same place. and travel the same road; but A goes 5 days before B at the rate of 20 miles a day. B follows at the rate of 25 miles a day: in what time. and at what distance will he overtake A:

Ans. 20 days, and 500 miles.

James. McCormick

M d M
100 : 5 : : 25
5
25)500(20 days
50
0

d M d
20 : 25 : 1
20
500 miles

20 days

Single Rule of Three, Inverse

General Rule.

1. If 30 horses plough 12 acres. how many will 40 horses plough in the same time:

h : h :: acr
30 : 40 :: 12
12
30)480(16 acres. Ans
30
180
180

2. If 30 horses plough 12 acres in 10 days; in how many days will 40 horses plough the same quantity:

Operation.

h : h :: D
40 : 30 :: 10
10
40)300(7.5 days Ans.
280
200
200

3. If 800 soldiers in a garrison have provisions sufficient for 2 months: how many must depart that the provisions may last them for 5 months: Ans. 480

5 : 2 :: 800 sol
2
5)1600
320

800 sol
320
480

4. Bought a hogshead of Madeira wine for 119 dollars. nine gallons of which leaked out. what is the remainder sold at per gallon. to gain 12 dollars on the whole:

Ans. 2 dollars. 42½ + cts.

gal : gal :: D
63 : 1 :: 119
lost 9 — 12 gain
54 — 131

54)131(2.425
108
230
216
140
108
320
270
50

5. If 225 pounds be carried 512 miles for 50 dollars. how many pounds may be carried 64 miles for the same money: Ans. 1800 lb.

M : M :: lb
64 : 512 :: 225
512
450
225
1125
64)115200(1800
64
512
512
00

6. If 8 dollars 5 cents be assessed on 1750 dolls. what is the tax of 10 dollars at the same rate:

Ans. 50 cents.

D : D C :: D
1750 : 87,50 :: 10
10
1750)87500(50
8750
0

The Double Rule of Three

1. If 6 men in 8 days earn 100 dollars. how much will 12 men earn in 24 days:

```
 288
 100                              6 men }                    { 12 men
600)28800(48 proof                8 days} : 100 : :          { 24 days
    2400                         48                            288
    4800                                                        100
    4800                                                  48)28800(600 dolls. Ans
                                                             288
                                                               00
```

2. If 10 bushels of oats suffice 18 horses for 20 days. how many bushels will serve 60 horses 36 days:

Ans. 60 bushels.

```
 18 horses}          { 60 horses
 20 days  } : 10 : : { 36 days
360                    360
                      180
                      2160
                          10
           360)21600(60 bushels
               2160
                  0
```

3. If 56 pounds of bread will suffice 7 men 14 days. how much bread will serve 21 men 3 days: Ans. 36 pounds.

```
  7 men }            { 21 men
 14 days} : 56 : :   {  3 days
 28                     63
  7                     56
 98                    378
                      315
               98)3528(36 pounds..
                  294
```

Double Rule of Three

4. If 8 students spend 384 dollars in 6 months. how much will maintain 12 students 10 months:

Ans. 960 dollars.

8 students
6 months } : 384 : : { 12 students, 10 moths
48

120
384
480
960
360
48) 46080 (960 dolls
432
288
288
0

5. If 20 hundred weight is carried 50 miles for 25 dollars. how much must be given for the carrage of 40 hundred weight 100 miles:

Ans. 100 dollars.

20 hundred
50 miles } : 25 : : { 40 hundred, 100 miles
1000

4000
25
20000
8000
1000) 100000 (100
1000
00

6. If 14 dollars interest is gained by 700 dollars in 6 months. what will be the interest of 400 dollars for 5 years:

Ans. 80 dollars.

700 dollars
6 months } : 14 : : { 400 dollars, 5 years
4200

12
60
24000
14
96000
24000
4200) 336000 (80 dolls
33600
0

7. If 4 men can do 12 rods of ditching in 6 days. how many rods may be done by 8 men in 24 days: Ans. 96 rods.

4 men
6 days } : 12 : : { 8 men, 24 days
24

132
16
192
12
24) 2304 (96 rods.
216
144
144

Double Rule of Three

Inverse Proportion.

1. If 4 dollars pay 8 men for 3 days: how many days must 20 men work for 40 dollars:

4 dolls } days { 40 dollars
8 men } : 3 : : { 20 men

1. Here the lower line is inverse. which transposed will stand thus.

As 4 dollars } days { 40 dollars.
20 men } : 3 : : { 8 men
80 — 320, 3
80) 960 (12 days Ans
80
160
160

2. If 4 men are paid 24 dollars for 3 days wk. how many days may 16 men be employed for 384 dollars: Ans. 12 days.

4 men } days { 16 men
24 dollars } : 3 : : { 384 dollars
16 — 4
384 — 1536, 3
384) 4608 (12 days
384
768
768

3. If 4 men are paid 24 dollars for 3 days work, how many men may be employed 16 days for 96 dollars: Ans. 3 men.

3 days } men { 16 days
24 dolls } : 4 : : { 96 dolls
16 — 3
144 — 288
24 — 4
384) 1152 (3 men, Ans.
1152

4. If 7 men can reap 8 acres of grain in 12 days, how many men can reape 100 acres in 5 days: Ans. 20 men

8 acres } men { 100 acres
12 days } : 7 : : { 5 days
5 — 12
420 — 1200, 7
420) 8400 (20
840
0

5. If 7 men can reap 8 acres of grain in 12 days. how many days will it require 20 men to reap 100 acres: Ans. 5 days.

7 men } days { 20 men
8 acres } : 12 : : { 100 acres
20 — 7
1680 — 700, 12
1680) 8400 (5 days. Ans
8400

Double Rule of Three

6. If 40 cents are paid for the carriage of 200 pounds for 40 miles, how far may 20200 pounds be carried for 60 dollars 60 cents:

Ans. 60 miles.

40 cents } miles { 6060 cents
200 pounds } : 40 :: { 20200 pounds

40
20200
8000
00
80
808000

6060
200
1212000
40
48480000 (60
4848000
0

7. If 5 men spent 200 dollars in 22 weeks and 6 days, how long will 300 dollars support 12 men:

Ans. 14 weeks 2 days.

5 men } 7 days { 12 men
200 dollars } : 22 : 6 : : { 300 dollars
12
2400

6 5
1500
160
90000
1500 7
240000 (100
2400 14=2
00

Promiscuous Questions

1. If 12 oxen in 8 days eat 10 acres of clover, how many acres will serve 24 oxen 48 days

Ans. 120 acres

12 oxen } acres { 24 oxen
8 days } : 10 :: { 28 days
96

192
96
1152
10
96) 11520 (120
96
192
192
0

2. A person having engaged to remove 8000 weight 15 miles in 9 days; with 18 horses in 6 days he removed 4500 weight: how many horses will be necessary to remove the rest, in the remaining 3 days:

Ans. 28 horses

8000
cwt. 4500 } horses { 4500
3500 cwt
days 6 } : 18 :: { 3 days
3
13500

6
21000
18
13500) 378000 (28
27000
108000
108000

Continued R. S.

3. If the carriage of 9 hogsheads of suar, each weighing 12 cwt. for 60 miles cost 100 dollars, what must be paid for the carriage of 50 barrels of sugar, each weighing 2.5 cwt. 300 miles: Ans. 578 dolls. 70+ cents.

12
9
cwt 108 } dollars : 100 :: { 50 / 2.5 / 250 / 100 / 125.0 cwt / 300 miles
miles 60
6480

37500
100
6480) 3750000 (578,70
32400
51000
45360
56400
51840
45600
45360
2400

4. If a cellar which is 22.5 feet long, 17.3 feet wide, and 10.25 deep is duge by 6 men in 2.5 days, working 12.3 hours each day; how many days of 8.2 hours will it require 9 men to dig one, which is 45 feet long, 34.6 wide and 12.3 deep: Ans. 12 days:

22.5 length
17.3 breadth
675
1575
225
389.25
10.25 depth
194625
77850
389250
3989.8125
men 6
hours 12.3
} Days : 2.5 ::

45 length
34.6 breadth
270
180
135
1557.0
12.3 depth
46710
31140
15570
19151.10
9 men
8.2 hours

23938.8750
12.3
7181662 50
4787775 00
2393887 50
294448.162 50

172359 90
8.2
3447198 0
1378879 20
1413351.18 0
2.5
7066755 90 0
2826702 36 0
294448.16250) 3533377.9 50 00 (12 days
294448 16 25 0
588896 3 2500
588896 3 2500

Practice

James McCormick

September the 21 day 1822

Examples.

1. What will 175 pounds of tea come to at 1 dollars 30 cents and 5 mills per pound:

```
  130.5
    175
  -----
   6525
  9135
 1305
 ------
 228,375

      cts.|   | 175
Or. 25 |1/4 | 4375
     5 |1/5 |  875
   5m |1/10|   875
            |228,375
```

228375 Ans. 228 dolls. 37 cts. 5 mills

2

```
        D
       250
         1
 50 |1/2 | 250
 25 |1   | 125
 75 |2   |  6250
            437,50 Ans
```

3

```
       D
      201
        4
 20 |1/5 | 804
            4020
          844,20 Ans
```

4

```
    yards
     2210
        1
 10 |1/10| 2210
            22100
          2431,00 Ans
```

5

```
      yards
       421
         2
 20 |1/5 | 842
 20 |1/5 |  842
  1 |1/20|  842
 5m |1/2 |   421
             2105
        1016,71.5 Ans
```

6

```
     yards
      625
 25 |1/4 | 15625 Ans
```

7

```
     yards
      8275
  4 |1/25| 331
 4m |1/10|  3310
           364,10 Ans.
```

8

```
       yards
           8275 ( D  C  m
 5m 200 |  800  ( 41,37.5 Ans
            275
            200
             750
             600
             1500
             1400
              1000
              1000
```

1. What will 375 yards of muslin cost at 3/4 of a dollar per yard:

```
   375 at 3/4
     3
4) 1125.
   281.25 Ans.
```

Practice

2

cwt	qr	lb	
4 .	1	14	$\frac{1}{4}$

```
    4
   17
   28
  140
   35
4)490
  122,50 Ans
```

2

3

cwt	qr	lb	
12	2	13	$\frac{3}{4}$

```
     4
    50
    28
   413
  100
  1413
     2
3)2826
   942
```

4.

cwt	qr	lb	
14	2	7	$\frac{7}{8}$

```
      4
     58
     28
    471
   116
5)1631
   3262
      7
8)22834
   285,42.5
```

Application

1. Bought 6 hogsheads of tobacco. each weighing 12.5 cwt. at $\frac{3}{8}$ of a dollars per pond: what did it cost: Ans. 3150 dolls.

hhd	cwt	dollar
6 .	12.5	$\frac{3}{8}$

```
       6
     75.0
        4
    300
     28
   2400
   600
   8400
      3
8)25200
   3150
```

2. A gentleman bought a vessel of 60 tons burden. and gave at the rate of $2\frac{3}{5}$ eagles per ton: what did the vessel cost: Ans. 1560 dolls.

$	eagles
6 .	$2\frac{3}{5}$

```
   2              60
 120               3
  36           5)180
 156              36
  10
1560
```

Practice Practice

3. A carpenter bought 12650 feet of boards at 10⅞ dollars per thousand: what did they cost him: Ans. 137 dolls. 56 cts. 8½ m

ft	ft
12650	12650
7	10
8) 88550	126.500
11.06.875	11.06.875
	137.56.875 Ans

Example

1. Bought 16 cwt. 1 qr. 16 lb. of tobacco at 12 dollars 44 cents per hundred weigt: what did it cost

12,44
16
7464
1244
1 qr is ¼ | 19904
16 lb ⅐ | 311
1777 1/7
203927 1/7 Ans. 203 dollars 92 cts 7 1/7 mills

2. 17 cwt. 3 qr. 19 lb. of sugar at 10 dollars 94 cents per hundred weight. Ans. 196 dolls. 4 cts.

D C
10,94
17
7658
1094
2 ½ 18598
1 ½ 547
½ 2735
14 ⅛ 13675
4 1/7 3907
1 ¼ 976
196,04.08 Ans

3. 5 cwt. 1 qr. 0 lb. of tobacco at 13 dollars 41 cents per hundred weight. Ans. 70 dolls. 40 cts. 2 m.

D C
1341
5
1 qr ¼ 6705
0 lb 33525
70,40.25 Ans

4. 7 cwt. 0 qr. 19 lb. of sugar at 15 dolls. 5 mills. per hundred weight. Ans. 107 dolls. 58 cts.

D M
15 005
0 qr ⅐ 105035
16 lb ⅛ 21435 7
2 ½ 2679 4
1 1339 7
107,58.048

1

Practice

1. What will 4548 yards come to at 1s. 6d. per yard:

or 6d. | 1/2 | 4548 at 1 shilling will be the same number of shillings.
2274
2(0) 682(2 shillings
341..2 = 909 dolls. 60 cts.

2. 475 yards at 6s. 8d. Ans. £157 13s. 4d. = 420 dolls. 44 4/9

yards
473
6
6 | 1/2 | 2838
2 | 1/3 | 236..6
78..10
2(0) 315(3..4
157..13..4
3153
12
9(0) 3784(0
420..44 4/9

3. 397 do. 3s. 4d. Ans. £66 3 4 =

yards
397
3
4 | 1/3 | 1191
132..4
2(0) 132(3..4
66..3..4

4. 159 1/4 lb. of coffee at 1s. 8d. Ans. £13 5 5 =

coffee
159 1/4
1
6 | 1/2 | 159..3
2 | 1/3 | 79 = 7 1/2
26..6 1/2
2(0) 26(5 5
13..5..5

5. lb.
658
12
2(0) 789(6
394 = 16. 0 =

6. 745 yds. of cloth at 16s. Ans. £596 0s. 0d. =

yds
745
16
4470
745
2(0) 1192(0
596.0.0 =

7. 969 do. 14s. 11d. Ans. £964 19s. 3d. =

Do
969
19
8721
969
6 | 1/2 | 18411
3 | 1/4 | 434 6
2 | 1/4 | 242 3
| 1/3 | 161 6
2(0) 1929(4 3
964..19..3 =

Practice

4. 7t. 4cwt. 2qr. 21lb. of rice at 3l. 17s. 6d. per cwt.

Ans. 560l. 13s. 3¼d.

		L	S	D
		3	17	6
				12×12=144
		46	10	0
				12
2	½	558	0	0
14	¼	1	18	9
7	¼	0	9	8¼
	½	0	4	10
		560	13	3¼

5. 476 acres 3 roods 28 perches of land at 3l. 7s. 11d. per acre.

Ans. 1619l. 11s. 1¾d.

		L	S	D	A
		3	7	11×6=476	
				10	
		33	19	2×7	
				10	
		339	11	8	
		1358	6	8	
		237	14	2	
		20	7	6	
R 2	½	1616	8	4	
1	¼	1	13	11½	
P 20	⅛	0	16	11¾	
8	⅛	0	8	5⅞	
	⅕	0	3	4¾	
		1619	11	1¾	

6. 640 acres 2 roods perches at 10 dollars 55 cents per acre

Ans. 6758 dolls. 59½ cts.

		D C
		1055×6
		10 = 640
		10550×4
		10
		105500
		6
		633000
		42200
2	½	675200
	¼	5275
20	¼	131875
		6758,59.3.75

7. 229 acres 3 roods 18 perches at 18 dollars 50 cents per acre.

Ans. 4252 dolls. 46½ cts

		D C
		1850×9
		10 = 229
		18500×2
		10
		185000
		2
		370000
		37000
		16650
R 2	½	423650
1	¼	925
P 10	½	4625
8	¼	115625
	⅕	925
		4252,45.6.25

Tare And Tret

Sames Tare And Tret

Section 2.

1. What is the neat weight of a hogshead of tobacco weighing gross 12 cwt. 3 qr. 12 ll. tare 14 ll. per cwt:

cwt	qr	ll
12	3	12
1	2	12
11	1	0

Ans

2. What will 3 barrels of sugar come to, weighing as follows: viz. no 1. 2 cwt. 1 qr. 25 ll. No. 2. 2 cwt. 2 qr. No. 3. 2 cwt. 21 ll. tare 21 ll. per barrel: at 12 dollars 50 cents per cwt: Ans. 82 dolls 47 cts 7 m

cwt	qr	ll
2	1	25
2	2	00
2	0	21
7	0	18
0	2	1[illegible]
6	2	[illegible]

824 7.76 65

3. At 45 cents per pound what will 4 barrels of indigo come to, weighing as follows:

	cwt	qr	ll	Tar ll
No. 1	3	3	2	29
No. 2	4	1	10	36
No. 3	4	0	19	32
No. 4	4	0	0	35
	16	1	3	
	1	0	20	
	15	0	11	

760,95 Ans

4. bought 9 hogsheads of sugar each weighing 6 cwt. 2 qr. 12 ll. gross: tare 17 ll. per cwt. what is the neat weight and what does it amount to at 16 dollars per cwt: Ans: neat 50 cwt. 1 qr. 22 ll. Amount 807 dolls. 14 c. 2 m

cwt	qr	ll	
6	2	12	tar 17
		9	
59	1	24	

$59 = 1 - 24$

$50 = 1 = 22$

807,142 Ans

5. Sold 27 bags of coffee, each 2cwt. 3qr. 17lb gross. tare 13lb. per cwt. tree 4 per 104: what is the neat weight and what will it come to at 32 cents per pound.

Ans. 66cwt. 2qr. 11lb. and comes to 2386 dolls 88 cts

cwt qr lb
78 = 1 = 11
9 0 10
69 1 1
4
277
28
2217
554
26)7757(298(10
52 28 2=2
255 18
234
217
208
19

cwt qr lb
69 1 1
2 2 18
66 2 11

cwt qr lb
2 3 17
9+3=27
26 0 13
3
78 1 11
13
234
78
1014
325
08125
046428
28)10180(36
84 9=0=10
178
168
10

cwt qr lb
66 : 2 : 11
4
266
28
2129
533
7459
32
14918
22377
2386,88

James McCormick

Simple Interest

Case 1.

1. What is the interest of 454 dollars for 1 year. at 6 percent:
Ans. 27 dolls. 24 cts.

D
454
6
27,24 Ans

2. Required the interest of the same sum for 5 years. at the same rate Ans. 136 dolls. 20 cts.

D
454
6
2724
5
136,20 Ans

3. Required the amount of the same sum for 5 years. at the same rate: Ans. 590 dolls. 20 cts

D
454
6
2724
5
13620
45400
590,20 Ans

4. What is the interest of 200 dolls for 2 years, at 6 percent: Ans 24 dolls

D
200
6
1200
2
24,00 Ans

5. What is the interest of 1260 dolls. for 4 years. at 7 percent:
Ans. 352 dollars 80 cents.

D
1260
7
8820
4
352,80 Ans

6. What is the amount of a note for 560 dollars for 3 years. at 8 percent
Ans. 694 dolls. 40 cts.

D
560
8
4480
3
13440
560,00
694,40 Ans

7. What sum must be given to discharge a bond given for 4520 dollars. on which there is 6 years interest, at 5 percent:
Ans. 5876 dolls

D
4520
5
22600
6
135600
452000
5876,00 Ans

Simple Interest

8. What is the amount of 400 dollars for 2 years. at 6½ per cent.
Ans. 452 dolls.

```
  D
 400
  6½
2400
 200
2600
   2
5200
40000
452,00 Ans
```

9. What is the intest of 4925 dolls for 9 years. at 7½ per cent:
Ans. 3324 dolls. 37 cts. 5 m.

```
   D
 4925
  7½
34475
 24625
369375
     9
3324,37.5 Ans
```

10. What is the amount of 2500 dollars for 1 year. at 7¾ per cent:
Ans. 2693 dolls. 75 cts.

```
  D
 2500
 7.75
12500
17500
17500
193,75.00 Ans
2500 0000
```

Case 2.

1. What is the interest of 264 dollars 50 cents for 1 year. at 6 per cent: Ans. 15 dolls cts.

```
  D
264,50
     6
15,87.00 Ans
```

2. What is the inerst of 468 dollars 22 cents and 5 mills for 1 year. at 8 percent: Ans. 37 dolls. 45. cts. 8 mills

```
  D C m
468,22.5
       8
37,45.18.00 Ans
```

3. What is the interest of 364 dolls 50 cents for 5 years. at 6 percent. per annum: Ans 109 dollars 35 cents.

```
 D C
36450
    6
218700
    5
109,3500 Ans
```

4. What is the amount of a note for 1260 dollars 60 cents and 5 mills for 3 years. at 7½ per cent. perannum:
Ans. 1544 dolls. 11 cents 5+ m.

```
 D C m
1260,60.5
      7.5
6302525
8823535
94537875
        3
283611625
1260605
1544,11.5 Ans
```

Simple Interest

5. what sum will discharge a bond given for 630 dollars 50cts on which there is 5 years interest at 8 percent per annum:
Ans. 882 dollars 70cts

D C
63050
8
504400
5
2522000
63050
882170

§§§ case 3 §§§

1. what is the interest of 650 dollars for 8 months at 6 per cent. per annum: Ans 26 dollars

D
650
4 half the months
cents 2600

2 what is the interest of 860 dollars for 1 year and 6 months at 6 percent. per annum:

D
860
9 half the months
7740 Ans 77 dolls 40cts

3. what is the interest of 420 dolls for 9 months at 8 percent. per annum:
9 months
8 percent
12)72
6 the rate for the time

D
420
6
2520 Ans 25 dolls 20cts

4 What is the amount of a note for 724 dollars with 18 months interest due thereon at 4 percent per annum
Ans. 767 dollars 44 cents.

18
4
12)72
6

D
724
6
4344
72400
767,44 Ans

5. What is the interest of 240 dollars for 15 months at 7½ percent per annum: Ans. 22 dolls 50 cents.

15 months
7.5
75
105
12)112.5
9.375
240
375000
18750
2250000 Ans

6. What is the interest of 1260 dollars for 4 months at 6½ percent per annum: Ans. 27 dolls 30cts.

M
6
4
6.5
20
24
12)26.0
2.166

D
1260
2.166
7560
7560
1260
2520
27,29.160
Ans

Simple Interest

case 4.

5. What is the intres of 12000 dollars for 40 days at 4 percent per annum: Ans. [illegible] dolls 56 cts

D
12000
40
5214)480000(92.6 nearly Ans
46926
10740
10428
31200

6 What is the interest of 8400 dollars for 20 days at 5 percent per annum: Ans 23 dolls.

D
8400
20
7300)168000(23+ Ans
14600
22000
21900
100

7. $ C 517.90 for 84 days at 6 percent per annum
Ans $ C m 7.15.1

D
51790
84
207160
414320
6083)4350360(7.15.1
42581
9226
6083
31430
30415
10150
6083
4067

8. $ C 5.73.41 days 27 Ans 33

$ C
7341
27
51387
14682
6083)198207(32.5 m Ans
18249
15717
12166
35510
30415
5095

9. $ C 225.24 days 40 Ans $ C m 1.48.1 +

$ C
225.24
40
6083)900960(1.48.1 Ans
6083
29266
24332
49340
48664
6760
6083
677

10. $ C 1200.00 days 80 Ans 15.78.1

$ C
1200.00
80
6083)9600000(15.78.1 Ans
6083
35170
30415
47550
42581
49690
48664
10260
6083
4177

Simple Interest

11. D C 2962.19 days 254 Ans. D C m 123.68.8

D C
2962,19
254
1184876
1481095
592438
6083)75239626(123.68.8 Ans
6083
14409
12166
22436
18249
41872
36498
53746
48664
50820
48664
2156

12. D C 1733.97 days 102 Ans D C m 29.7.5

D C
173397
102
346794
00000
173397
6083)17686494(29.7.5+ Ans
12166
55204
54747
45794
42581
32130
30415
1715

case 5.

2. What principal being put to interest for 12 years at 6 per cent per annum will amount to 2752 dollars. Ans. 1600 dolls.

year
12
6
72
100
172 : 100 :: 2752 D D
100 Ans
172)275200(1600
172
1032
1032
00

3. Received 728 dollars as payment in full for a note with 5 years interest thereon at 6 per cent per annum for how much was the note given?

Ans. 560 dollars.

years
5
6
30
100
130 : 100 :: 728 D D
100
130)72800(560
650
780
780
0

Case 6.

Simple Interest

2. Paid 858 dollars in full for a note given for 650 dollars with 4 years interest due thereon: what was the rate per cent. per annum charged on said note: Ans. 8 per cent.

```
 858       D       D       D     D
 650
 208 Ans 650 : 208 :: 100 : 32
                 100
        650)20800(32
            1950
             1300      4)32
             1300        8 Ans
```

3. At what rate per cent. will 1600 dollars amount to 2752 dollars in 12 years: Ans. 6 per cent.

```
 2752      D        D      D    D
 1600
 1152 Ans 1600 : 1152 :: 100 : 72
                  100
        1600)115200(72
             11200
              3200  12)72
              3200     6 Ans
```

Case 7.

2. In what time will 650 dollars amount to 910 dollars at 8 per cent. per annum: Ans. 5 years

```
 650          D    year   D
   8
 52,00 Ans 52 :  1  ::  260
 910 amount
 650 principal      52)260(5 Ans
 260                   260
```

3. In what time will 1600 dollars amount to 2080 dollars at 6 per cent. per annum. Ans. 5 years.

```
 1600         D    year   D
    6
 96,00 Ans 96 :  1  ::  480
 2080
 1600               96)480(5 Ans
  480                  480
```

Case 8.

Simple Interest Mc [illegible]

1. A has B's note for 1000 dollars. dated 1st January 1816, payable in 18 months with interes from the date At 6 percent per annum. On which the following paymunts are endorsed viz.

1000
3
3000
1000
1030
230 sec P
500
3
24,00
500
52400
300 third P
524
1½
524
262
786
524
531,56 forth P
254
277,86
1½
277,86
13893
416,79
277,86
252,62,79

1. A bond was given B to C. for 2400 dollars, payable in 2 years with interest from the date. Dated July 1. 1815. On this bond the fllowing payments are endorsed, viz. May 1. 1816, 900 dollars. Oct. 1. 1816, 450 dollars. January 1. 1817. 620 dollars. Required the amount due on the 1st of May 1817.

1815. July 1. principal 2400 dollars.
1816. May 1. 2400 multiplied by 304 — 729600
paid 900
1500 — 153 — 229500
Oct. 1. paid 450
1050
1816. Jan 1. Paid 620 — 42 — 96600
430
May 1. interest 184 55 — 120 — 5160.0
Ballance 614,55 Ans — Divide by 6(0))11073 0(0
184,55 interest

2400
900
1500
450
1050
620
430

4
1050
620
430
120
8600
430
51600
229500
729600
96600
6.0)1107300
184,55 interest
430
Ballance 614,55 Ans

3
1500
450
1050
92
2100
9450
96600

2
1500
153
4500
7500
1500
229500

1
2400
304
9600
0000
7200
729600

Compound Interest

James

3. What is the amount of 1500 dollars for 5 years, at 5 percent. perannum. Ans 1914 dolls. 42 cts.

127628
1500
63814000
127628
1914,42.000 Ans

4 What is the compound interest of 4500 dollars for 16 years at 6 per cent. perannum.

Ans. 6931 dolls. 57 cts. 5 m.

2.54035
4500
1270175000
1016140
11431,57.500
4500
6931.57.500 Ans

5 A has B's note for 650 dollars payable at the end of 20 years at 6 percent. per annum. compound interest; what sum will it require to discharge the note at the expiration of the given time.

Ans. 2084 dolls. 63 cts. 4 m.

3.20713
650
16035650
1924278
2084,63.450 Ans

6. A father left a legacy of 8000 dollars at compound interest, 6 per cent. perannum. to be equally divided among his three sons. when the youngest who was 4 years old. should arrive at the age of 21; what will be each one's share

Ans. 7180 dolls. 72 cts. each share

2.69277
8000
3)21542160000
7180,72 Ans

Insurance Commission and Brokage

§§§ Section 4. §§§

1 What is the premium of insuring 1260 dollars at 5 per cent:

```
 1260
    5
 63,00   Ans 63 dollars
```

2. 1650 dollars at 15½ per cent.

Ans D. 255,75 C.

```
  1650
   15½
  8250
 1650
   825
 25575 Ans
```

3. 4500 dolls 25 Ans D 1125 C 00

```
   D
  4500
    25
 22500
 9000
 1125,00 Ans
```

4. What sum must a policy be taken out for, to cover 900 dollars, when the premium is 10 per cent:

```
 100
  10
  90
90 : 100 : 900
           100
90)90000(1000 ans
   90
     000
```

5. What sum will it require to cover a policy of insurance for 4500 dollars at 25 per cent: Ans 6000 dollars

```
   D
  100
   25
   75
As 75 : 100 : : 4500
                100
75)450000(6000 Ans
   450
     000
```

6. What sum will it require to cover a policy of insurance for 560 dolls. at 9 per cent:

Ans. 615 dollars. 38 $\frac{5}{2}$ c

```
 100
   9
  91
91 : 100 : : 560
             100
  )56000(615,38 6/13
   546
    140
     91
     490
     455
      350
      273
       770
       728
     7)42|6
       91|13
```

James McCormick

And Brokage And Brokage
InsuranceCommission,

Commission. \$\$\$

2 What is the commission on 1260 dollars. at 6 percent:
Ans. 75 dolls. 60 cts.

D
1260
6
75,60 Ans

3. 2550 dolls at 4 percent. Ans. D 102 C 00

D
2550
4
102,00 Ans

4. 26342 dolls 3 percent Ans D 790 C 26

D
26342
3
790,26 Ans

5. 6422 by 3/4 Ans 48,16½

D
6422
.75
32110
44954
48,16,50 Ans

6. A commission merchant receives 1260 dollars to fill an order, from which he is instructed to deduct his own commission of 5 percent. how much will remain to satisfy the order:

1200 dolls. Ans

D
100
5
105 : 100 :: 1260
100

105) 126000 (1200 Ans
105
210
210
00

7. A commission merchant has received 4120 dollars with instruction to vest it in salt at 8 dolls per barrel: deducting from it his commision of 3 percent. how many barrels of salt can he purchase:

Ans. 500 barrels.

D
100
3
103 : 100 :: 4120
100

103) 412000 (4000
412
000

8) 4000
500 Ans

Insurance Commission And Brokage

Brokage

2. What is the brokage on 1625 dollars 50 cents, at 3⅓ percent: Ans. 54 dolls. 18 cts.

D
1625,50
3⅓
487650
54183.3
54,18.33 3.3 Ans

3. 1868 dollars at 2½ percent. Ans. 46 dolls. 70 cts.

D
1868
2½
3736
934
46,70 Ans

4. 560 at 6 33 dolls 60 cts

D
560
6
33,60 Ans

Buying And Selling Stocks

Section 5.

1. What is the amount of 1650 dolls. United States bank Stock, at 125 per cent. or 25 per cent. above par.

```
      1650
       125
      8250
     3300
    1650
100)2062,50 Ans. 2062 dolls 50 cts
```

Or thus. 25 is ¼) 1650
```
          412 50
         2062 50 Ans
```

2. 1500 bank stock at 110 per cent. Ans. 1650,00 dolls

```
    1500
     110
   15000
  1500
  1650,00 Ans
```

3. 1686 at 128 Ans 2158,08

```
     1686
      128
    13488
    3372
   1686
   2158,08 Ans
```

4. 25000 at 108 Ans 27000,00

```
    25000
      108
   200000
   00000
  25000
  27000,00 Ans
```

5. 1260 at 90 Ans 1134,00

```
   1260
     90
 113400 Ans
```

6. 925 4 at 84 Ans 777336

```
    9254
      84
   37016
  74032
  77733,6 Ans
```

7. 1518 at 83¾ Ans 1271.32½

```
     1518
    83.75
    75 90
   10626
   4554
  12144
  1271,32.50 Ans
```

Rebate or Discount

Sections.

2. what is the present worth of 2464 dollars. due 1 year and 6 months hence, discounting at the rate of 8 per cent. per annum.

Ans 2200 dollars.

100 D. D D
112 : 100 : : 2464
100
112) 246400 (2200
224
224
224
00

3. A has B's note for 1864 dollars 50 cents payable 5 months after date: what is the present worth of said note discounting at the rate of 8½ per cent per annum: Ans. 1794 dolls. 80 cts.

M D M D
12 : 8.5 : : 5
8
12) 440 (3.66
36
80
72
80
72
8

100
3.66
103,66 : 100 : : 1864,50
1864,50
100
103,66) 18645000 (1798,65
10366
82791
72562
102290
93294
89960
10366
94940
93294
16460
10366
60940
51830
9110

4. What reduction must be made for prompt payment of a note for 650 dollars due 2 years hence, 7 per cent. per annum being allowed for discount:

Ans. 79 dollars. 83+ cts.

D years
1 : 7 : : 2
2
14
100
114 : 100 : : 650
100
114) 65000 (570,17
570
800
798
200
114
860
798
62

650.00
570.17
79,83+ Ans

5. what is the present worth of a 5150 dollars due in 4½ months. discounting at the rate of 8 per cent. per annum. and allowing 1 per cent. for prompt payment:

Ans. 4950 dollars

M D M
12 : 8 : : 4.5
8
12) 360
3 per cent
100 D
103 : 100 : : 5098,50
100

5150.00 principle
51.50 amt. of 1 per cent

10300) 5098,5000 (4950 Ans
41200
97850
92700
51500
51500
0

Rebate or Discount

1. what is the discount of 1272 dollars due in 12 months. discounting at 6 per cent. per annum.

Ans 106 : 100 :: 1272 : 1200

Discount 72 dols.

2. What is the interest of the same sum for the same time and rate:

```
 1272
    6
 76.32 interest.  D. C.
                  76 32
                  72
                   4 32
```

3. What is the difference between the interest and discount 7280 dollars for 18 months at 8 percent. per annum: Ans. 93 dolls. 60 cts. difference

```
12 : 8 :: 18
          8
   12)144
       12
      100
      112 : 100 :: 7280
                     100
          112)728000 (6500
              672
               560
               560
                 00

 7280
 6500
  780

   7280
      8
  58240
  29120
  873,60
  780
  93,60 Ans
```

1. what much is the discount of 260 dollars at 5 per cent

```
 260
   5
 13,00  Ans. 13 dollars
```

2. what is the discount on 1650 dolls at 3 percent.

Ans. 49 dolls. 50 cts.

```
 1650
    3
 49,50  Ans
```

3. what sum will discharge a bond for 2464 dolls. on which a discount of 8 per cent. is given:

Ans. 2266 dollars. 88 cents.

```
  D
 2464
    8
 197,12

  2464 00
   197,12
  2266,88
```

Bank Discount

M'Cormick
James

Section 7.

2. What is the discount of 250 dollars for 30 days:

Ans. 1 dollar. 41⅔ cts

```
 D
250
 34
1000
750
6|0) 8.50|0(0
     1.41 4/6 2/3  Ans
```

3. What is the discount of 600 dollars for 90 days:

Ans. 9 dolls. 40 cts.

```
  D
 600
  94
2400
5400
6|0) 564|00
     9,40  Ans
```

4. what is the discount of 1260 dollars 40 cents for 60 days:

Ans. 13 dollars. 44 cts.

```
    D
1260 40
     64
504160
756240
6|0) 806656|0
     13,44.4.2 +   Ans
```

5. What is the discount of 2649 dollars 75 cents for 60 days:

Ans. 28 dolls. 26 cents. 4 m.

```
 D    C
2649 75
     64
1059900
1589850
6|0) 1695840|0
     28,26.4.0   Ans
```

Equation of Payments

§§§ Section 8. §§§

1. A owes B 600 dollars of which 200 is to be paid in 4 months, 200 at 8 months, and 200 at 12 months: but they agree to make but one payment: when must that payment be made:

D

200×4=800
200×8=1600
200×12=2400
600) 4800 (8 months Ans
4800

2. A merchant has owing to him from his friend the sum of 3000 dollars to be paid as follows viz. 500 dolls at 2 months. 1000 dollars at 5 months. and the rest at 8 months: but they agree to make one payment of the whole: what will be the mean time of payment: Ans. 6 months.

500×2= 1000
1000×5= 5000
1500×8= 12000
3000) 18000 (6 Ans
18000

3. A buys of B 50 acres of land for which he agrees to pay 1000 dollars at the following times viz 200 dollars at 5 months. 300 dolls at 8 months. and the rest at 10 months: but an equation of payments is afterwards agreed upon: when the payment be made: Ans. 8 months 12 days.

D

200×5=1000
300×8=2400
500×10=5000
1000) 8400 (8, 12 Ans
8000
400
30
) 12000 (12
1000
2000
2000

4. C owes D 1400 dolls. to be paid in 3 months but D being in want of money C pays him 1000 dollars at the expiration of 2 months: how much longer than 3 months may he in Justice defer the payment of the rest: Ans. 2½ months: D

M 1400
1000
1000 : 1 :: 400
400) 1000 (2 months
800
200 2.15 Ans
30
400) 6000 (15 days
400
2000

4. 1400×3=3200
1000×1=1000
2200 (5.5
2000 (2.5 Ans
2000

Fellowship

James McCorn

Section 9.

1. two merchants Join their stock in trade: A puts in 600 dollars. and B puts in 400 dolls. and they gain 250 dollars: what part belongs to each;

A 600
400
1000

As 1000 : 250 :: 600 to A 150
400 to B 100
250 Ans

2. three merchants enter into partnership in trade: A advanced 7500 dollars. B 6000. and C 4500, with this they gained 5400 dollars. what was each partner's share:

7500
6000
4500

7500
6000
4500

18000 : 5400 :: 7500
7500
2700000
37800
18000) 40500000 (2250 Ans
36000
45000
36000
90000
90000
0

18000 : 5400 :: 6000
6000
18000) 32400000 (1800 Ans
18000
144000
144000
00

18000 : 5400 :: 4500
4500
2700000
21600
18000) 24300000 (1350 Ans
18000
63000
54000
90000
90000
0

Ans { A 2250 dollars
B 1800
C 1350
5400 Proff

3. A bankrupt is indebted to A 1291 dollars 23 cents. to B 500 dollars 37 cents. to C 709 dollars 40 cents. to D 228 dollars: and his estate is worth but 2046 dollars 75 cents: how much does he pay per cent. and how much is each creditor to receive:

1291,23
50037
70940
228
272900 : 204675 :: 129123
129123
614025
409350
204675
1842075
409350
204675
264282500025 (968,42 1/4 Ans
245610.0.
1867250
1637400
2298500
2183200
115300 2
109160 0
614025
545800
68225
27 2900
27 2900 (1/4

Single Fellowship

272900 : 204675 :: 50037
50037
1432725
614025
[illegible]
10233 7600
10241 32297 5 (375,27 $\frac{3}{4}$ Ans
818700
2054322
1910300
1440229
1364500
757295
545800
2114950
1910300
204650
4
818700
818700 ($\frac{3}{4}$

272900 : 204675 :: 70940
70940
8187000
1842075
1432725 0
14519644500 (53205 Ans
1364500
874644
818700
559445
545800
1364500
1364500

272900 : 204675 :: 228
228
1637400
409350
409350
46665900 (171 Ans
272900
1937590
1910300
272900
272900

75 percent. A receives 968 42 $\frac{1}{4}$
Ans. he pays B 375 27 $\frac{3}{4}$
C 532 05
D 171

272900 : 204675 :: 100
100
20467500 (75 percent
1910300
1364500
1364500

4. Three men. A. B. and C. rent a farm containing 585 acres 2 roods and 34 perches. at 600 dollars per year; of which A pays 180 dolls. B 195, and C 225. and they agree that the farm shall be divided in proportion to the rents; how many acres must each man have:

d	a	r	p
180	585	2	34
195	4		
225			
600			

2342
40
: 93714 : : 180
180
7497120
93714
600) 16868520 (28114
1200
4868
4800
685
600
852
600
2520
2400
12) 120 = 1
600 = 5

40) 28114
4) 702 = 3 Ans
175 - 2 = 34 $\frac{1}{5}$

Single Fellowship

James [illegible]

600 : 93714 :: 195
195
468570
843426
93714
600)18274230(30457
1800
2742
2400
3423
3000
4230
4200
3)30 = 1
60 = 20

40)30457
4)761=1
190=1=17 1/20 Ans

600 : 93714 :: 225
225
468570
187428
187428
600)21085650(35142
1800
3085
3000
856
600
2565
2400
1650
1200
15)450 = 3
600 = 4

40)35142
4)878 2
219=2=22 3/4 Ans

		A	B	D
Ans	A's share is	175	2	34 1/5
	B's	190	1	17 1/20
	C's	219	2	22 3/4

5. Three merchants freighted a ship with 2160 barrels of flour of which 960 barrels belongid to A. 720 barrels to B. and 480 barrels to C; but on acount of stormy weather they were obliged to throw 900 barrels overboard: how many barrels did each man loss?

B
960
720
480

B B
2160 : 900 :: 960
960
54000
8100
2160)864000(400 Ans
8640
00

2160 : 900 :: 720
720
18000
6300
2160)648000(300 Ans
6480
00

2160 : 900 :: 480
480
2160)432000(200 Ans
4320
00

Ans { A lost 400 barrels.
B 300
C 200 }

6. Three merchants join stock in trade: A put in 1260 dollars. B 840 dollars and C a certain sum. and they gained 825 dollars of which C took for his part 275 dollars; required A and B's part of the gain, and how much stock C put in:

Single Fellowship

D
1260
840
2100

D
825 whole Gain
275 C's Gain
: 550 :: 1260
1260
33000
1100
550
2100)693000(330 dolls. A's G
6300
6300
6300
0

550 d.
330 d's G
220 B's G

220 : 840 :: 275
275
4200
5880
1680
231000(1050 C's stock
220
1100
1100
0

Ans. { A gained 330 dolls. / B 220 / C's stock was 1050 }

7. Four men traded with a stock of 800 dollars, and they gained in two years time twice as much, and 40 dollars over; A's stock was 140 dollars, B's 260. C's 300; required D's stock, and what each gained.

D
140
260
300
100
800

D
800
700
100 D's stock

D D D
800 : 1640 :: 140
140
65600
640
800)229600(287 A's share
1600
6960
6400
5600
5600

800 : 1640 :: 260
260
98400
3280
800)426400(533 B's sha
4000
2640
2400
2400
2400

800 : 1640 :: 300
300
800)492000(615 C's sha
4800
1200
800
4000
4000

800 : 1640 :: 100
100
800)164000(205 D's sha
1600
4000
4000

Ans. { D's stock was 100 dollars / A's gain was 287 / B's 533 / C's 615 / D's 205 }

Compound Fellowship

Examples

1. Three merchants entered into trade: A put in 2500 dollars for 4 months. B 3000 dollars for 6 months and C 4000 dolls for 8 months and they gained 1200 dollars what is each man's share of the gain:

A 2500×4 = 10000
B 3000×6 = 18000
C 4000×8 = 32000
sum 60000

As 60000 : 1200 :: { 10000 : 200 dls share
18000 : 360 dls
C 32000 : 640 dls }

1200 proof

2. Three merchants enter into partnership for 16 months: A put into stock at first 600 dolls. and at the end of 8 months 200 dollars more: B put in at first 1200 dollars but at the end of 10 months was obliged to take out 600 dollars: C put in at firs 1000 dollars and at the end of 12 months put in 800 more: with this stock they gained 2300 dolls: What is each man's share:

600×16 = 9600 + 1600 = 11200
200×8 = 1600
1200×10 = 12000 + 3600 = 15600
600
600×6 = 3600
1000×16 = 16000 + 3200 = 19200
800×4 = 3200
46000

46000 : 2300 :: 11200
11200
460000
2300
2300
46000) 25760000 (560 Ans
230
276
276
0

46000 : 2300 :: 15600
2300
4680000
31200
46000) 35880000 (780 Ans
322
368
368
0

46000 : 2300 :: 19200
2300
5760000
38400
46000) 44160000 (960 Ans
414
276
276
0

Ans { A's share is 560 dollars
B's 780
C's 960 }

Compound Fellowship

3: A and B join stock in trade: A put in 600 dollars on the first of January. B advanced on the first of April a sum which entitled him to an equal share of the profit at the end of the year: required the sum B put in. Ans. 800 dollars

```
 M    D    M
12 : 600 :: 9
      12
9)7200(800 Ans
  72
  --
   00
```

11. D put in stock 1800 dollars: & at the end of 11 months agreed to admit E such a sum as at the end of the year will entitle him to an equal share of the profits: what sum must E advance.

Ans. 2700 dollars

```
 M    D     M
12 : 1800 :: 8
       12
8)21600(2700 Ans
  16
  --
   56
   56
   --
   00
```

5. two gentlemen A and B hired a carriage in pittsburgh to go to philadelphia and return for 160 dollars with liberty to take in two others by the way. when at philadelphia they took in C and afterwards 100 miles from pittsburgh they took in D. Now allowing it to be 300 miles from pittsburgh to philadelphia and also that each man pays in proportion to the distance he rode: it is required to tell how much each must pay:

```
A  600
B  600
C  300
D  100
   ----
   1600 : 160 :: 600
                 600
   1600)96000(60 A
        9600   60 B
        ----   30 C
           0   10 D
               ---
               160 proof

1600 : 160 :: 300
              300
      )48000(30 C
       4800
       ----
          0

1600 : 160 :: 100
              100
      )16000(10 D
       1600
       ----
          0
```

Ans { A pays 60 dollars
B 60
C 30
D 10
160 proof.

Profit And Loss

§§ Section 10. §§§

2. Bought a piece of cloth for 1 dollar and 20 cents per yard. and sold it again for 1 dollar 50 cents a yard: what is the gain per cent.

Ans 25 per cent:

```
 C
150
120
120 : 30 :: 100
             30
120)3000(25 Ans
    240
     600
     600
```

3. Bought a piece of linen containing 42 yards for 21 dolls. and sold it at 66 cents per yard; what is the gain or loss on the whole piece:

Ans. 6 dolls. 42 cts gain.

```
yards  C       yards
1 :   66   ::  42
      42
     132
    264
    2772
    21
    6,72 Ans
```

4. A merchant bought 6 barrels of whiskey containing 32 gallons each for 96 dollars; while in his possession he lost 12 gallons by leakage. the residue he sold for such a sum as gained him 12 dollars. the residue he sold for such a sum as gained him 12 dolls on the whole. how much per gallon did he buy and sell for: Ans bought for 50 cents. and sold for 60 cents per gallon

```
 barls
   6
  32
  12
 18
192 :  D    B
      96 :: 1.
      9600(50 Ans
      960
        0

192     96
 12     12
180 :  108 :: 1
180)10800(60 Ans
    1080
       0
```

5. Bought 120 dozen of knives for 20 cents each knife. and sold them again for 14 cents each. what was the loss on the whole: Ans. 43 dolls. 20 cts.

```
     C
    20
    14
1 : 3 :: 1440
            3
        43,20 Ans
```

Profit And Loss

6. A merchant gave 149 dollars for 100 yards of cloth at how much per yard must he sell it to gain 51 dollars on the whole:

Ans. 2 dollars.

Yards D yards
100 : 200 :: 1
100)200(2 Ans
200

C
90
20
100 : 120 :: 90
90
100)10800(1,08 Ans
100
800
800

1,08
90
1 : 18 :: 240
18
1920
240
43,20 Ans

7. Bought a chest of tea at 1 dollar and 25 cents per pound. but finding it to be of an inferior quality. I am willing to lose 18 per cent. by it: how must I sell it per pound:

Ans. 1 doll. 2½ cts. per lb.

D
100
18
100 : 82 :: 125
82
250
1000
100)10250
1,02½ Ans

8. A merchant bought 20 dozen of wool hats at 90 cents per hat: at what rate must he sell them again to gain 20 per cent. and how much does he gain on the whole:

Ans. he must sell at 1 doll. 8 cts per hat. and gains 43 dolls 20 cts

9. A trader bought a hogshead of rum of a certain proof containing 115 gallons. at 1 dollar 10 cents per gallon: how many gallons of water must he put into it to gain 5 dollars. by selling it at 1 dollar per gallon:

Ans. 16½ gallons.

D C
G 110
G 100 G
1 : 10 :: 115
10
1150
C G 5
100 : 1 :: 1650
100)1650(16.5 Ans
100
650
600
500
500

A D

Profit And Loss

10. A merchant bought 4 hundred weight of coffee for 134 dollars 40 cents, and was afterwords obliged to sell it at 25 cents per pound: what was his loss on the whole and how much on each pound: Ans. 5 cents loss on each pound, and 22 dolls. 40 cts. on the whole.

lb D C lb
448 : 134,40 :: 1
1344)30
0)25
5 Ans

lb
1 : 5 :: 448
5
22,40 Ans

11. If by selling 360 yards broad cloth for 1728 dollars there is gained 20 per cent. profit. what did it cost per yard Ans. 4 dollars.

D D D
120 : 100 :: 1728
100
120) 172800 (1440 first cost
120
528
480
480
480
0

Yards D
360 : 1440 :: 1
1440 (4 Ans

12 A merchant laid out 1000 dolls on cloth, at 4 dollars per yard, and sold it again at 4 dollars 90 cents per yard, what was his whole gain: Ans. 225 dolls.

D yards D
4 : 1 :: 1000
250

Yards C
1 : 90 :: 250
90
225,00 Ans

13. A sells a quantity of wheat 1 dollar per bushel, and gains 20 per cent.; shortly after he sold of the same to the amount of 37 dollars 50 cents, and gained 50 per cent. how many bushels were there in the last parcel, and at what rate did he sell it per bushel. Ans. 30 bushels, at 1 doll. 25 cts. per bushel.

C C C
120 : 100 :: 100
100
120) 10000 (83⅓ first Cost
100 : 150 :: 83⅓
83⅓
450
1200
50
100) 1,25 00 sold for

D C Bu D C
1,25 : 1 :: 3750 (30 bushels sold
375
0

P

Profit and Loss

14. A Trader is about purchasing 5000 galls. of whiskey. which he can have at 48 cents per gallon in ready money. or 50 cents with 2 months credit; which will be the most profitable. either to buy it on credit. or by borrowing the money at 8 per cent. per annum. to pay the cash price: Ans. He will gain 68 dolls. by paying the cash.

```
G    C     G
1 : 48 :: 5000
          5000
        2400,00
          3200
        2432

G    C     G
1 : 50 :: 5000
            .50
         250000
          2432
            68 Ans

M   D    M
12 : 8 :: 2
     2
12)16
   1 1/3

 D     D      D
100 : 1 1/3 :: 2400
                1/3
               2400
                800
           1(00)32(00
```

15. A butcher bought 12 head of beef cattle of equal weight. for 240 dollars. which he sells again for 4 cents per pound; what ought each one to weigh. that the butcher may have the hides and tallow as clear gain: Ans. 4cwt. 1qr. 24lb.

```
C  lb   D C
4 : 1 :: 240.00
4)24000
12)6000
28)500(17    4
   28      qr  lb
   220   4-1=24
   196
    24
```

Barter Barter

Section 11.

1. how many yards of linen at 50 cents per yard must be given for 6¼ yards of broad cloth at 4 dolls 50 cents per yard.

```
  D C
 4,50 dolls
   6¼
 2700
 112½
 28,12½
As C yd D C yds
  50 : 1 :: 28.12½ : 56¼ Ans.
```

2. A has 320 bushels of salt at 1 dollar 20 cents per bushel, for which B agrees to pay him 160 dollars in cash and the rest in coffee at 20 cents per pound: how much coffee must A receive: Ans. 1120 lb.

```
B  D C      B
1 : 1,20 :: 320
             120
            6400
            320
           38400
 C  lb      160
20 : 1 :: 22400
2(0) 2240(0
     1120 Ans
```

3. How much rye at 40 cents per bushel must be given for 28 bushels of wheat, at 1 dollar 25 cents per bushel:

Ans. 50 bushels.

```
B  D C     B
1 : 1.25 :: 28
            28
          1000
  C B      250
 40 : 1 :: 3500
4(0) 350(0
      .50 bushels Ans
```

4. A barters 319 lb. of coffee at 23½ cents per pound with B for 250 yards of muslin: what does the muslin cost A per yard:

Ans. 30 cents nearly

```
lb  C      lb
1 : 23½ :: 319
            23½
            957
           638
           1595
250 : 74,96.5 :: 1
250) 74,96.5 (29,9.8 Ans
     500
     2496
     2250
      2465
      2250
       2150
       2000
        150
```

5. C has flour at 5 dollars per barrel, which he barters to D at a profit of 20 per cent. for tea which cost 1 dolls 25 cents per pound: at what rate must D sell the tea to make the barter equal.

Ans. 1 doll. 50 cts. per lb.

```
D   D C    D
100 : 120 :: 5
              5
1(00) 6(00
5 : 6 :: 125
           6
5) 750
   1,50 Ans
```

Barter

6. P has 240 bushels of rye which cost him 90 cents per bushel: this he barters with Q at 95 cents per bushel for wheat which stands Q 99 cents per bushel; how many

6. A has cloth which cost him 2 dollars 50 cents per yard. but in trade h must have 2 dollars 80 cents B has wheat at 1 dollars 20 cents per bushel: at how mucl per bushel shou ld he sell to A. to make the barter equal: Ans. 1 doll. 34 2/5 cts

D C : D C :: D C
2,50 : 2,80 :: 120
120
2,50)33600(1,34 2/5 Ans
250
860
750
1100
1000
5)100 = 2
  250 = 5

7. P has 240 bushels of rye which cost him 9 cents per bushel; this he barters with Q at 95 cents per bushel for wheat which stands Q 99 cents per bushel; how many bushels of wheat is he to receive in barter and at what price, that their gains many be equal;

Ans. 218 38/209 bushels at 1 doll 4 1/2 cents per bushel.

C : C :: C
90 : 95 :: 99
95
495
891
90)9405(1,04 1/2 price
90
405
360
45)45 = 1
   90 = 2

B : C :: B
1 : 95 :: 240
95
1200
2160
1045 : 1 :: 22800 00(218 38/209 Ans
2090
1900
1045
8550
8360
5)190 = 38
  1045 = 209

8. A gives B in barter 26 lb. 4 oz. of cinnamon, at 1 dollars 28 cents per pound, for rice at 6 cents per pound: how much rice must A receive: Ans. 5 cwt.

lb : D C :: lb oz
1 : 128 :: 264
16
16
16
160
26
420
128
3360
840
420
16 : 1 :: 53760(3360
48
57
48
96
96

C : A
6 : 1 :: 3360
6)3360
28)560(4)20
56   5 Ans
0

Barter James

9 C and D barter: C has muslin that cost him 22 cents per yard and he puts it at 25 cents: D cost him 28 cents per yard. at what price must he put it to gain 10 per cents. more than C: Ans 35 cents per yard.

C : FC :: C
100 : 125 :: 28
28
1000
250
3500 (35 cts per yard
300
500

10. A buys 250 barrels of flour from B at 6 dollars 25 cents per barrel, in payment B takes 4cwt of coffee at 30 cents per pound, 6 lbs of tea at 1 dollar 75 cents per lb. 25 yards of broad cloth at 6 dollars per yard, 206 dollars 10 cents in cash. and the balance in salt. at 8 dollars per barrel: how many barls of salt must B receive:

Ans. 120 barrels

B : FC :: B
1 : 625 :: 250
250
31250
1250
156250
60250
96000

lb : C :: lb
1 : 30 :: 448
30
13440

lb : FC :: lb
1 : 175 :: 64
64
700
1050
11200

yard : D :: yards
1 : 6 :: 25
6
150

134,40
112 00
150
206 10
602,50

D : B :: D
8 : 1 :: 960
120 barrels Ans

C
10 | 10 | 25
2.5
D 22 : 27.5 :: 28
28
2200
550
22) 770.0 (35 cts per yard
66
110
110

B B

Exchange

Section Case 1.

1. What is the value of 480l. pennsylvania currency in North carolina

S d : S :: £
7 6 : 8 :: 480
20
9600
12
115200
8
90)921600
12)10240
20)512 Ans

2 What is the value of 256l. New york currency in pennsylvania: Ans 240l.

S : S d :: £
8 : 7 6 :: 256
12 20
90 5120
90
8)460800
12)57600
20)4800
240 Ans

3 How much Suth Carolina currency is equal to 1500l. of New Jersey Ans. 933l 6s.8d.

S d : S d :: £
7 6 : 4 8 :: 1500
12 12 20
90 56 30000
12
360000
56
2160000
1800000
90)20160000
12)224000
20)18666=8
933=6=8 Ans

4. What sum New york currency is equal to 180l. in Massachusetts. Ans. 240l.

S : S :: £
6 : 8 :: 180
20
3600
8
6)28800
20)4800
240 Ans

5. How much Virginia currency will purchase a bill for 280l. South carolina. Ans 360l

S d : S :: £
4 8 : 6 :: 280
12 20
56 5600
12
67200
6
56)403200(7200
392
112
112
00
20)7200
360 Ans

Exchange Exchange

6. A bill of exchange being remitted from rhode Island to South Carolina for 304 l. what is its value in the currency of the latter: Ans 236 l. 8 s. 10½ d. +

```
 s     s  d      £
 6  :  4  8  ::  304
      12          20
      56        6080
                  56
               36480
              30400
            6)340480
           12)56746=2
           20)4728=10
              236=8=10½
```

Case 2.

1. Change 127 l. 12 s. New England money to dollars and cents.

127 l. 12 s = 2552 shillings. the dollar New England is

```
6 s.)2552
     425,33⅓
```
Ans. 425 dolls. 33⅓ cts

2. Change 37 l. 10 s. pennsylvania currency to dollars.

```
  £   s
  37 10
  20
  750
  12
9)9000
  100,00  Ans
```

3. Change 225 l. 12 s. New york currency to federal money.

225 l. 12 s = 4512 shillings ÷ 8 the dollar New york currency = 564 dolls. Ans.

```
   £   s
  225  12
   20
8)4512
  564  Ans
```

4. A bill of exchange for 468 l. 19 s. 6 d. virginia currency is remitted to philadelphia. what is its value in federal money. Ans. 1563 dolls. 25 cts.

```
   £    s   d
  468 . 19 . 6
   20
  9379
   12
72)112554(1563,25 Ans
   72
   405
   360
    455
    432
     234
     216
      180
      144
       360
       360
```

5. A merchant deposited in the United States branch bank at pittsburgh. the sum of 750 l. 10 s. pennsylvania currency. for what sum may he draw for in federal money.

Ans. 1563 dollars 25 cts

```
   £   s
  750 10
   20
  15010
     12
90)180120(2001,33⅓ Ans
   180
    120
     90
     300
     270
     300
     270
      30
```

Foreign Exchange C E K

Case 3

1. philadelphia is indebted to london 1749 l. currency. what sum sterling must be remitted when the exchange is 65 per cent.

£ 165 : £ 100 :: £ 1749
100
165)174900(1060 : Ans
165
990
990
0

2. london is indebted to philadelphia 1060 l. Sterling what sum pennsylvania currency must be remitted the exchange being 65 per cent. as above:

£ 100 : £ 165 :: £ 1060
165
5300
6360
060
100)174900(1749 £ Ans
100
749
700
490
400
900
900

Baltimore Octo 1814.

Exchange for 1260 l. 10 s. sterling thirty days after sight of this my first of exchange second and third of like tenor and date not being paid. pay to Mr. B. or order. twelve hundred and sixty pounds ten shillings sterling value received. and place the same to account as per advice from.

W. B. L merchant. london.

What is the value of this bill in federal money. 1260 l. 10 S = 1260 $ + by 444 cents = 5596 dolls. 62 cts. Ans.

£ 1 : C 444 :: £ 1260 S 10
20 20
20
25210
444
100840
100840
100840
20)11193240
5596,62 Ans

4 Exchange for 5596 dolls 62 cts. federal money. thirty days after sight of this my second of exchange first and third of the same tenor and date not paid. pay to J. B. or order five thousand five hundred and ninety six dolls sixty two cents value received. and place the same to account. as per advice from S. S.

Mr. J. L. Merchant Baltimore

How much sterling is the above bill. 444 cents to the pound

444)5596,62(1260
444
1156
888
2686
2664
222
20
4440(10 Ans. £ 1260 . S 10
444
0

Foreign Exchange &c.

5. A merchant of philadelphia receives from his correspondent in Dublin a bill of exchange for 540l. 15s. Irish currency what is its value in federal money.

Ans. 2217 dolls. 7½ cts.

£ 1 : £ 410 :: £ 540 s 15
20 / 20 — 10815 — 410 — 108150 — 43260 — 20)44341.50 — 2217,07.5 Ans

6. A merchant in philadelphia draws on his correspondent in Dublin for the balance of an account amounting to 2217 dollars 7½ cts. what sum Irish currency must be remitted to satisfy the draft:

Ans. 540l. 15s.

D C 410 : £ 1 :: D C 2217,07.5

410)2217,07.5(
2050
1670
1640
307.5
20
410)61500(15
410
2050
2050

£ s 540 15 Ans

7. In a settlement between A of London and B of philadelphia. B is indebted to A in the sum of 320l. sterling what sum must remitted by B to A to settle the balance. the exchange being 12½ per cent from the United States to great Britain Ans. 1598 dolls. 40 cts.

£ 320 × 12½ — 3840 — 160 — 4000 — 320 — 360

D C 444 × 360 — 26640 — 1332 — 1598.40 Ans

8. C of New-york remits 3280 dollars to his correspondent in Dublin to be placed to his account; for what sum Irish currency must he receive credit. the course of exchange being 8 percent. in favour of Ireland:

Ans. 736l. nearly.

D 3280 × 8 — 26240

410)301760(736 Ans
2870
1476
1230
2460
2460

Alligation

Section 1. case 1.

1. A merchant mixed 2 gallons of wine at 2 dollars per gallon, 2 at 2 dollars 50 cents, and 2 at 3 dollars: what is one gallon of this mixture worth:

G.
2 at 2.00 = 400
2 at 2.50 = 500
2 at 3.00 = 600
6 — 1500

Ans G. D C G D C
6 : 15,00 :: 1 : 2,50 Ans.

2. A grocer mixed 20 lb. of sugar at 10 cents per lb. 3 lb. at 15 cents and 40 lb. at 25 cents; what is one pound of this mixture worth: Ans. 18⅓ cts.

lb C D C
20 at 10 = 200
30 at 15 = 450
40 at 25 = 1000
90 — 16,50

lb D C lb
90 : 1650 :: 1
90)1650(18⅓ Ans
90
750
720
3) 30 = 1
90 = 3

3. A trader mixes 10 bushels of at 150 cents, 20 at 160 cents, and 30 at 170 cents per bushel: at what rate can he afford to sell one bushel of this mixture: Ans. 163⅓ cents.

B D C
10 at 150 = 1500
20 at 160 = 3200
30 at 170 = 5100
60 — 9800

B D C B
60 : 9800 :: 1
60)9800(163⅓ Ans
60
380
360
200
180
2) 20 = 1
60 = 3

4. If 4 ounces of silver at 75 cents per ounce be mixed with 8 ounces at 60 cents per ounce, what is the value of one ounce of this mixture: Ans. 65 cents.

oz C D C
4 at 75 = 300
8 at 60 480
12 — 780

oz D C oz
12 : 780 :: 1
12)780(65 Ans
72
60
60

Alligation

Case 2.

1. How many pounds of tea at 150, 160 and 200 cents per pound must be mixed together that one pound may be sold for 180 cents:

Mean rate 180 {150, 160, 200} — 20 at 150 cts, 20 at 160, 30+20=50 at 200 — Ans

150 × 20 = 3000
160 × 20 = 3200
50 × 2 = 100
3000 + 3200 + 100 ... 90 : 162.00 :: 1
90) 16200 (1,80 Proof

2. how many gallons of wine at 3, 5, and 6 dollars per gallon must be mixed together that one gallon may be worth 4 dollars; Ans 3 gal at 3 dolls 1 gal at 5 dolls and 1 gallon at 6 dolls

	Gal	Doll
4 {3, 5, 6}	1+2=3 at	3
	1 at	5
	1 at	6

3. how many bushels of rye at 40 cents per bushel and corn at 30 cents must be mixed with oats at 20 cents to make a mixture worth 25 cents per bushel:

	Bus	cts
25 {40, 30, 20} 5+5=	20 at	20
	5 at	30
	5 at	40

4. A grocer has four several sorts of tea viz. one kind at 120 cents, another at 110 cents, another at 90 cents, and another at 80 cents per pound. how much of each sort must be taken to make a mixture worth 1 dollar per pound:

1
100 {120, 110, 90, 80} — 2, 1, 1, 2 Ans

2
100 {120, 110, 90, 80} — 2+1=3, 2, 2, 2+1=3 Ans

3
100 {120, 110, 90, 80} — 1, 2, 2, 1 Ans

4
100 {120, 110, 90, 80} — 1, 2+1=3, 1+2=3, 1 Ans

5
100 {120, 110, 90, 80} — 2+1=3, 1, 1+2=3, 2 Ans

6
100 {120, 110, 90, 80} — 2, 2+1=3, 1, 2+1=3 Ans — 9

240
330
90
240
9) 900 (100 Cents

Proof

Alligation

James McCormick 1843

§§§ Case 3. §§§

1. A grocer would mix 40 pounds of sugar at 22 cents per pound with some at 20, 14, and 12 cents per pound. how much of each sort must he take to mix with the 40 pounds, that he may sell the mixture at 18 cents per pound:

$$18\begin{cases}12 & 4\text{lb.}\\14 & 2\\20 & 4\\22 & 6\end{cases}$$

6 : 40 : : 4

4

6) 160 (26.66 lb. at 12 cts and 20
12
40
36
40
36
40
36
4

6 : 40 : : 2

2

6) 80 (13.33 lb. at 14 cents
6
20
18
20
18
20
18
2

2. How much wheat at 48 cents, rye at 36 cents, and barley at 30 cents per bushel, must be mixed with 24 bushels of oats at 18 cents per bushel, that the whole may rate at 22 cents per bushel:
Ans. 2 bushels of each.

$$22\begin{cases}18 & 26+14+8=48\\30 & 4\\36 & 4\\48 & 4\end{cases}$$

48 : 24 : : 4

4

48) 96 (2 bushels of each
96

3. How much gold at 16, 20, and 24 carats fine, and how much alloy must be mixed with 10 ounces of 18 carats fine, that the composition may be 22 carats fine:

Ans. 10 oz. of 16 carats fine, 10 of 20 170 of 24 and 10 of alloy.

$$22\begin{cases}16 & 2\\18 & 2\\20 & 2\\24 & 6+4+2+22=34\\00 & 2\end{cases}$$

2 : 10 : : 2

2

2) 20
10 oz.

2 : 10 : : 34

10

2) 340
170 oz.

Alligation Last

Case 4.

1. How much sugar a 10. 12, and 15 cents per pound. will be required make a mixture of 40 pounds. worth 13 cents penr pound:

$$13\begin{cases}10 & 2\\12 & 2\\15 & 3+1=4\end{cases}$$

8 Sum of the different simples.

Ans 8 : 40 :: 2
8)80 (10 lb.

As 8 : 40 :: 4
8)160 (20 do.

As 8 : 40 :: 2
8)80 (10 lb do.

2. How much gold of 15. of 17. of 18, and of 22 carats fine must be mixed together to form a mixture of 40 ounces of 20 carats fine: Ans. 5 oz. of 15. of 17. and of 18. and 25 oz. of 22.

$$20\begin{cases}15 & 2\\17 & 2\\18 & 2\\22 & 5+3+2=10\end{cases}$$

16

16 : 40 :: 2
16)80 (5 oz. of
80

16 : 40 :: 10
16)400 (25 oz of
32
80
80

3. How many gallons of water must be mixed with wine at 6 dollars per gallon to fill a vessel 70 gallons. so that it may be sold without loss. at 5 dollars per gallon:

Ans. $11\frac{2}{3}$ gallons of water.

$$5\begin{cases}6 & 5\\0 & 1\end{cases}$$

6

As 6 : 70 :: 1
6)70 ($11\frac{2}{3}$ Ans
6
10
6
2)4/6 = 2/3

A Last

James McCormick

Vulgar Fractions

Case 1.

1. Reduce $\frac{36}{48}$ To its lowest terms.

36)48(1
36
12)36(3
36

$\frac{3}{4}$ Ans

12)48(4
48

2. Reduce $\frac{144}{216}$ to its lowest terms. Ans $\frac{2}{3}$

144)216(1
144
72

72)144(2
144

$\frac{2}{3}$ Ans

72)216(3
216

3. Reduce $\frac{75}{125}$ to its lowest terms. Ans. $\frac{3}{5}$

75)125(1
75
50)75(1
50
25)125(5
125

$\frac{3}{5}$ Ans

25)75(3
75

4 Reduce $\frac{4800}{10800}$ To its Lowest terms Ans. $\frac{4}{9}$

48(00)108(00(2
96
12)48(00(4
48

$\frac{4}{9}$ Ans

12).108(00(9
108

5. Reduce $\frac{91}{117}$ To its lowest terms Ans. $\frac{7}{9}$

91)117(1
91
26)91(3
78
13)117(9
117

$\frac{7}{9}$ Ans

13)91(7
91

6. Reduce $\frac{9876}{88884}$ to its lowest terms. Ans $\frac{1}{9}$

9876)88884(9
88884

Case 2.

H B

Reducton of vulgar fractions

1. Reduce $8\frac{3}{4}$ to an improper fraction.

$$\begin{array}{r} 8 \\ 4 \\ \hline 32+3 = \frac{35}{4} \end{array}$$ Ans

2. Reduce $12\frac{15}{17}$ to an improper fraction. Ans. $\frac{219}{17}$

$$\begin{array}{r} 12 \\ 17 \\ \hline 84 \\ 12 \\ \hline 204+15 = \frac{219}{17} \end{array}$$ Ans

3. Reduce $183\frac{5}{21}$ to an improper fraction. $\frac{3848}{21}$ Ans

$$\begin{array}{r} 183 \\ 21 \\ \hline 183 \\ 366 \\ \hline 3843+5 = \frac{3848}{21} \end{array}$$ Ans

4. Reduce $514\frac{5}{16}$ to an improper fraction. $\frac{8229}{16}$ Ans

$$\begin{array}{r} 514 \\ 16 \\ \hline 3084 \\ 514 \\ \hline 8224+5 = \frac{8229}{16} \end{array}$$ Ans

5. Reduce $68425\frac{3}{4}$ to an improper fraction. $\frac{273703}{4}$ Ans

$$\begin{array}{r} 68425 \\ 4 \\ \hline 273700+3 = \frac{273703}{4} \end{array}$$ Ans

Case 3.

1. Reduce $\frac{35}{4}$ to its proper terms.

$4)35(8\frac{3}{4}$ Ans
32
—
3

2. Reduce $\frac{3848}{21}$ to its proper terms. Ans $183\frac{5}{21}$

$21)3848(183\frac{5}{21}$ Ans
21
—
174
168
—
68
63
—
5

3. Reduce $\frac{2465}{7}$ to its proper terms. Ans $352\frac{1}{7}$

$7)2465$
$352\frac{1}{7}$ Ans

4. Reduce $\frac{961}{17}$ to its proper terms. Ans $56\frac{9}{17}$

$17)961(56\frac{9}{17}$ Ans
85
—
111
102
—
9

5. Reduce $\frac{8229}{16}$ to its proper terms. Ans $514\frac{5}{16}$

$16)8229(514\frac{5}{16}$ Ans
80
—
22
16
—
69
64
—
5

Reduction of Vulgar Fractions

Reduction of Vulgar Fractions

Case 4.

1 Reduce $\frac{1}{2}$ $\frac{2}{3}$ $\frac{3}{4}$ to a common denominator.

$1\times3\times4=12$
$2\times2\times4=16$
$3\times2\times3=18$ } numerators
$2\times3\times4=24$ common denominator

Ans. $\frac{12}{24}$ $\frac{16}{24}$ $\frac{18}{24}$

2 Reduce $\frac{3}{4}$ $\frac{4}{5}$ $\frac{5}{6}$ to a common denominator. Ans $\frac{90}{120}$ $\frac{96}{120}$ $\frac{100}{120}$

$\frac{3}{4}$ $\frac{4}{5}$ $\frac{5}{6}$

$3\times5\times6=90$
$4\times4\times6=96$
$5\times4\times5=100$
$4\times5\times6=120$

$\frac{90}{120}$ $\frac{96}{120}$ $\frac{100}{120}$ Ans

3 Reduce $\frac{1}{3}$ $\frac{3}{5}$ $\frac{4}{15}$ $\frac{5}{9}$ to a common denominator.

$1\times5\times15\times9=675$
$3\times3\times15\times9=1215$
$4\times3\times5\times9=540$
$5\times3\times5\times15=1125$

$3\times5\times15\times9=2025$

$\frac{675}{2025}$ $\frac{1215}{2025}$ $\frac{540}{2025}$ $\frac{1125}{2025}$ Ans

1 Reduce $\frac{1}{2}$ $\frac{2}{3}$ $\frac{5}{6}$ $\frac{7}{8}$ to the least common denominator.

3) 2 3 6 8
2) 2 1 2 8
1 1 1 4 $4\times2\times3=24$

Divisors
2) 24
3 $12\times1=12$
6 $8\times2=16$
8 $4\times5=20$
 $3\times7=21$

then $\frac{12}{24}$ $\frac{16}{24}$ $\frac{20}{24}$ $\frac{21}{24}$ Ans.

2. Reduce $\frac{2}{3}$ $\frac{3}{8}$ $\frac{4}{12}$ $\frac{5}{20}$ to the least common denominator.

4) 3 8 12 20
3) 3 2 3 5
1 2 1 5

5 × 2 = 10 × 3 = 30 × 4 = 120

Divisors
3) 120
 $40\times2=80$
8 $15\times3=45$
12 $10\times4=40$
20 $6\times5=30$

$\frac{80}{120}$ $\frac{45}{120}$ $\frac{40}{120}$ $\frac{30}{120}$ Ans

3. Reduce $\frac{1}{3}$ $\frac{3}{5}$ $\frac{4}{15}$ $\frac{5}{9}$ to the least common denominator.

3) 3 5 15 9
5) 1 5 5 3
1 1 1 3

3 × 5 = 15 × 3 = 45

Divisors
3) 45
 $15\times1=15$
5 $9\times3=27$
15 $3\times4=12$
9 $5\times5=25$

$\frac{15}{45}$ $\frac{27}{45}$ $\frac{12}{45}$ $\frac{25}{45}$ Ans

Case 5.

P L

Vugar Fractions

Case 6.

1. Reduce $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{4}{5}$ to a single fraction.

$\frac{2\times3\times4=24}{3\times4\times5=60}=\frac{2}{5}$ Ans

Or cancelled

$\frac{2\ 3\ 4}{3\ 4\ 5}=\frac{2}{5}$ Ans

2. Reduce $\frac{7}{8}$ of $\frac{4}{6}$ of $\frac{9}{10}$ to a single fraction.

$\frac{7\times4\times9}{8\times6\times10}=\frac{252}{480}=\frac{21}{40}$ Ans

3. Reduce $\frac{5}{9}$ of $\frac{4}{8}$ of $\frac{3}{4}$ to a single fraction.

$\frac{5\ 4\ 3}{9\ 8\ 4}=\frac{15}{72}=\frac{5}{24}$ Ans

4. Reduce $\frac{5}{9}$ of $\frac{4}{7}$ $\frac{11}{12}$ to a single fration.

$\frac{5\times4\times11}{9\times7\times12}=\frac{220}{756}=\frac{55}{189}$ Ans

Case 7.

1. Reduce $\frac{5}{6}$ of a penny to the fraction of a pound.

$\frac{5\times1\times1}{6\times12\times20}=\frac{5}{1440}=\frac{1}{288}$ Ans.

2. Reduce $\frac{4}{5}$ of a pennyweight to the fraction of a pound troy. Ans. $\frac{1}{300}$

$\frac{4\times1\times1}{5\times20\times12}=\frac{4}{1200}=\frac{1}{300}$ Ans.

3. Reduce $\frac{9}{13}$ of a pint of wine to the fraction of a hogs head. Ans. $\frac{1}{728}$

$\frac{9\times1}{13\times504}\ \frac{9}{6552}=\frac{1}{728}$ Ans

4. Reduce $\frac{10}{11}$ of a minute to the fraction of a day. Ans $\frac{1}{1584}$

$\frac{10\times}{11\times1440}\ \frac{10}{15840}=\frac{1}{1584}$ Ans

Case 8.

Z

Z

Z

Reduction of Vulgar fractions

1. Reduce $\frac{5}{1440}$ of a pound to the fraction of a penny.

$$\begin{array}{r} 20 \\ 12 \\ \hline 240 \\ 5 \\ 12)\overline{1200} \\ 1440 \end{array} \quad (2) \quad \frac{10}{12} = \frac{5}{6} \text{ Ans}$$

2. Reduce $\frac{1}{300}$ of a pound troy to the fraction of a pennyweight. Ans $\frac{4}{5}$

$$\begin{array}{r} 12 \\ 20 \\ 6)\overline{240} \\ 300 \end{array} = \frac{4}{5} \text{ Ans}$$

3. Reduce $\frac{1}{728}$ of a hogshead to the fraction of a pint. Ans. $\frac{9}{13}$

$$\begin{array}{r} 63 \\ 4 \\ \hline 252 \\ 2 \\ 8)\overline{504} \\ 728 \end{array} \quad (7) \quad \frac{63}{91} = \frac{9}{13} \text{ Ans}$$

4. Reduce $\frac{1}{1584}$ of a day to the fraction of a minute. Ans. $\frac{10}{11}$

$$\begin{array}{r} 24 \\ 60 \\ 6)\overline{1440} \\ 1584 \end{array} \quad (24) \quad \frac{240}{264} = \frac{10}{11} \text{ Ans}$$

Case 9.

K K

1. What is the value of $\frac{2}{3}$ of a pound sterling

20 shilling = 1 pound.

$$\begin{array}{r} 20 \\ 2 \\ 3)\overline{40} \\ 13.4 \end{array}$$ Ans. 13s. 4d.

2. Reduce $\frac{3}{5}$ of a pound troy to proper quantity. Ans. 7oz. 4dwt.

$$\begin{array}{r} 12 \\ 3 \\ 5)\overline{36} \\ 7oz.\ 4dwt. \end{array}$$ Ans.

3. Reduce $\frac{4}{5}$ of a mile to its proper quantity. Ans. 6 fur. 16 p.

$$\begin{array}{r} 8 \\ 4 \\ 5)\overline{32} \\ 6 \end{array}$$ fur. 16 p. Ans.

4. Reduce $\frac{3}{10}$ of a day to its proper time.

$$\begin{array}{r} 24 \\ 3 \\ 10)\overline{72} \\ 7h. \end{array}$$ 12 mi. Ans.

5. What is the value of $\frac{4}{5}$ of a dollar. Ans. 80cts.

$$\begin{array}{r} 100 \\ 4 \\ 5)\overline{400} \\ 80 \end{array}$$ cts Ans

Case 10.

Z D

Reduction of Vulgar Fractions

1. Reduce 6s. 8d. to the fraction of a pound

S. d.
6 8
12
80) 80/240 = 1/3 Ans

1
20
12
240

2 Reduce 25 cents to the fraction of a dollar.

25) 25/100 = 1/4 Ans

3. Reduce 31 gallons 2 quarts to the fraction of a hogshead. Ans. 1/2.

G qr
31 . 2
4
126) 126/252 = 1/2 Ans.

63
4
252

4. Reduce 6 hundred weight 2 quarters 18 2/3 pounds to the fractions of a ton. Ans. 1/3.

cwt qr lb
6 2 18 2/3
4
26
28
226
53
746
3
2240) 2240/6720 = 1/3 Ans

T
1
20
20
4
80
28
640
160
2240
3
6720

Case 11.

1. Reduce 3/4 to a decimal fraction of the same value

4) 300
,75 Ans.

2. Reduce 17/20 to a decimal fraction. Ans. .85.

20) 17
.85 Ans

Addition of Vulgar Fractions

Case 1.

1. Add $\frac{1}{12}$ $\frac{5}{12}$ $\frac{7}{12}$ $\frac{9}{12}$ and $\frac{11}{12}$ together

numerators.

$$\begin{array}{r} 1 \\ 5 \\ 7 \\ 9 \\ 11 \\ 12)\overline{33}(2\tfrac{3}{4} \text{ Ans} \\ \underline{24} \\ \frac{9}{12} = \frac{3}{4} \end{array}$$

2 Add $\frac{4}{25}$ $\frac{8}{25}$ $\frac{13}{25}$ $\frac{16}{25}$ and $\frac{19}{25}$ together.

$$\begin{array}{r} 4 \\ 8 \\ 13 \\ 16 \\ 19 \\ 25)\overline{60}(2\tfrac{2}{5} \text{ Ans} \\ \underline{50} \\ 5)\frac{10}{25} = \frac{2}{5} \end{array}$$

3. Add $\frac{15}{60}$ $\frac{25}{60}$ $\frac{45}{60}$ and $\frac{55}{60}$ together.

$$\begin{array}{r} 15 \\ 25 \\ 45 \\ 55 \\ 60)\overline{140}(2\tfrac{1}{3} \text{ Ans} \\ \underline{120} \\ 2)\frac{20}{60} = \frac{1}{3} \end{array}$$

Case 2.

1 Add $\frac{1}{2}$ $\frac{3}{4}$ $\frac{5}{8}$ $\frac{9}{12}$ together.

$$\begin{array}{l} 2)\underline{2\ 4\ 8\ 12} \\ 2)\underline{1\ 2\ 4\ 6} \\ \quad 1\ 1\ 2\ 3 \end{array}$$

$$\begin{array}{r} 2 \\ \underline{3} \\ 6 \\ \underline{2} \\ 12 \\ \underline{2} \\ 24 \end{array}$$

$$\begin{array}{ll} 2)\underline{24} & \\ \quad 12\times1=12 & \\ 4 & 6\times1=18 \\ 8 & 3\times1=15 \\ 12 & 2\times1=18 \end{array}$$

$$\begin{array}{r} 24)\overline{63}(2\tfrac{15}{24} \text{ Ans} \\ \underline{48} \\ \frac{15}{24} \end{array}$$

2 Add $\frac{1}{2}$ $\frac{1}{4}$ $\frac{1}{5}$ $\frac{1}{8}$ together.

$$\begin{array}{l} 2)\underline{2\ 4\ 5\ 8} \\ 2)\underline{1\ 2\ 5\ 4} \\ \quad 1\ 1\ 5\ 2 \end{array}$$

$$\begin{array}{r} 5 \\ \underline{} \\ 10 \\ \underline{2} \\ 20 \\ \underline{2} \\ 40 \end{array}$$

$$\begin{array}{ll} 2)\underline{40} & \\ \quad 20\times1=20 & \\ 4 & 10\times1=10 \\ 5 & 8\times1=8 \\ 8 & 5\times1=5 \end{array}$$

$$\begin{array}{r} 40)\overline{43}(1\tfrac{3}{40} \text{ Ans} \\ \underline{40} \\ \frac{3}{40} \end{array}$$

K

Addition of Vulgar fractions

3. Add $\frac{4}{5}$ $\frac{5}{6}$ $\frac{6}{7}$ $\frac{3}{8}$ $\frac{8}{15}$ together.

```
5)5 6 7 8 15
2)1 6 7 8 3
3)1 3 7 4 3
  1 1 7 4 1
          4
          4
          7
         28
          3
         84
          2
        168
          5
5)840
   168×4= 672
6  140×5= 700
7  120×6= 720
8  105×3= 315
15  56×8= 448

840)2855(3 67/168 Ans
    2520
  5)336=67
    840=168
```

Case 3.

1. Add $13\frac{1}{15}$ $9\frac{4}{15}$ $3\frac{7}{15}$ together.

```
13 1/15
 9 4/15
 3 7/15
     12
25 12/15 = 4/5 Ans
```

2. Add $5\frac{2}{3}$ $6\frac{7}{8}$ $4\frac{1}{2}$ together.

```
5 2/3 = 5 16/24 Com. denom
6 7/8 = 6 21/24
4 1/2 = 4 12/24
        49/24 = 2 1/24
   15
    2 1/24
   17 1/24 Ans
```

3. Add $1\frac{3}{5}$ $\frac{4}{5}$ of $\frac{1}{3}$ $9\frac{3}{20}$ together.

$\frac{4}{5}$ of $\frac{1}{3}$ = $\frac{4}{15}$

```
5|3/5 4/15 3/20
  1  3  4
        3
       12
        5
5)60
   12×3 = 1 36/60
15  4×4 =   16/60
20  3×3 = 9  9/60
          11 1/60 Ans
```

4. Add $1\frac{4}{10}$ $6\frac{7}{8}$ $\frac{2}{3}$ of $\frac{1}{2}$ $7\frac{1}{2}$ together.

$\frac{2}{3}$ $\frac{1}{2}$ 2)$\frac{2}{6}$ $\frac{1}{3}$

```
2)4/10 7/8 1/3 1/2
   5  4  3  1
            3
            3
            4
           12
            5
           60
            2
10)120
    12×9 = 1 108/120
8   15×7 = 6 105/120
3   40×1 =   40/120
2   60×1 = 7 60/120
          16 73/120 Ans

120)313(2
    240
     73
```

Addition of Vulgar Fractions

Case 4.

1 Add $\frac{7}{9}$ of a £ and $\frac{3}{10}$ of a shilling.

$$9)\overline{140}\;(15 \quad 6\tfrac{6}{9}=\tfrac{2}{3} \qquad 10)\overline{36}\;(3\tfrac{6}{10}=\tfrac{3}{5}$$

$\frac{2}{3}$ $\frac{3}{5}$

	s	d
5×2 =	15 :	6 $\frac{10}{15}$
3×3 =	00 :	3 : $\frac{9}{15}$
	15 ..	10 $\frac{4}{15}$ Ans

2 Add $\frac{1}{2}$ of a yard to $\frac{2}{3}$ of a foot.
Ans. 2 feet 2 inches

$$2)\overline{3}\;1 \cdot 6 \qquad 3)\overline{24}\;8$$

2 .. 2 Ans

3. Add $\frac{1}{3}$ of a day to $\frac{1}{2}$ of an hour.
Ans. 8 hours 30 min.

$$3)\overline{24}\;8 \qquad 2)\overline{60}\;30$$

	H.	M.
$\frac{1}{3}$ of a day =	8 ..	00
$\frac{1}{2}$ of an hour =	0 ..	30
	8 ..	30 Ans

4. Add $\frac{1}{3}$ of week. $\frac{1}{4}$ of a day and $\frac{1}{2}$ of an hour together.
Ans. 2 days 14 hours 30 min.

$$3)\overline{7} \qquad 4)\overline{24}\;6 \qquad 2)\overline{60}\;30$$

2 ..	8 ..	00
0 ..	6 ..	30
2 ..	14 ..	30 Ans

5. Add $\frac{7}{8}$ of a mile. $\frac{2}{3}$ of a yard, and $\frac{3}{4}$ of a foot together. Ans. 1540 yards 2 feet 9 inches.

$$8)\overline{12320}\;1540 \qquad 3)\overline{6}\;2 \qquad 4)\overline{36}\;9$$

1540 : 2 : 9 Ans

Section 3.

S L T H S Ja

Subtraction of Vulgar fractions

From $\frac{7}{8}$
Take $\frac{3}{8}$
Rem. $\frac{4}{8}=\frac{1}{2}$ Ans.

From $\frac{6}{7}$
Take $\frac{3}{7}$
Rem. $\frac{3}{7}$ Ans.

From $\frac{2}{3}=\frac{8}{12}$
Take $\frac{1}{4}=\frac{3}{12}$
$\frac{5}{12}$ Ans.

4

From $\frac{11}{12}$
Take $\frac{3}{4}$
Rem. $\frac{1}{6}$

$4)\frac{11}{12}\ \frac{3}{4}$
3 1
4
12
(12) 12
$1\times11=\frac{11}{12}$
$4:3\times3=\frac{9}{12}$
$2)\frac{2}{12}=\frac{1}{6}$ Ans

5

From $\frac{5}{6}$
Take $\frac{4}{5}$
Rem. $\frac{1}{30}$

$\frac{5}{6}\ \frac{4}{5}$
6
(6) 30
$5\times5=\frac{25}{30}$
5 $6\times4=\frac{24}{30}$
$\frac{1}{30}$ Ans

6

From $\frac{209}{216}$
Take $\frac{7}{144}$
Rem $\frac{397}{432}$

$2)\frac{209}{216}\ \frac{7}{144}$
$9)108\ \ 72$
$4)12\ \ 8$
3 2
2
6
4
24
9
216
2
(216) 432
$2\times209=\frac{418}{432}$
144 $3\times7=\frac{21}{432}$
$\frac{397}{432}$ Ans

7

From $\frac{15}{16}$
Take $\frac{11}{12}$
Rem. $\frac{1}{48}$

$4)\frac{15}{16}\ \frac{11}{12}$
4 3
3
12
4
(16) 48
$3\times15=\frac{45}{48}$
12 $4\times11=\frac{44}{48}$
$\frac{1}{48}$ Ans

8

From $12\frac{5}{12}$
Take $6\frac{1}{2}$
Rem. $5\frac{11}{12}$

$2)\frac{5}{12}\ \frac{1}{2}$
6 1
2
(12) 12
$1\times5=12\frac{5}{12}$
2 $6\times1=6\frac{6}{12}$
$5\frac{11}{12}$ Ans

9

From $13\frac{1}{9}$
Take $8\frac{14}{27}$
Rem. $4\frac{16}{27}$

$9)\frac{1}{9}\ \frac{14}{27}$
1 3
9
(9) 27
$3\times1=13\frac{3}{27}$
27 $1\times14=8\frac{14}{27}$
$4\frac{16}{27}$ Ans

Subtraction of Vulgar Fractions

From $10\frac{3}{10}$
Take $1\frac{7}{12}$
Rem $8\frac{43}{60}$

$2)\frac{3}{10}\ \frac{7}{12}$
$5\ \ 6$
6
30
2
(10) 60
$6\times3=10\frac{18}{60}$
12 $5\times7=1\frac{35}{60}$
$8\frac{43}{60}$ Ans

From $\frac{7}{9}$ of a £ = 15 S. $6\frac{6}{9}$ D.
Take $\frac{3}{10}$ of a S. = 0 $3\frac{3}{5}$
15 $3\frac{1}{15}$

Rem

S. 20, 7, $9)140$ (3) $15 : 6\frac{6}{9} - \frac{2}{3}$
D. 12, 3, $10)36$ (2) $3 : \frac{6}{10} - \frac{3}{5}$

S D
$15 : 6\frac{10}{15}$
$0\ 3\frac{9}{15}$
$15 : 3\frac{1}{15}$ Ans

From $19\frac{5}{11}$
Take $0\frac{7}{15}$
Rem. $18\frac{163}{165}$

$\frac{5}{11}\ \frac{7}{15}$
15
55
11
(11) 165
$15\times5=19\frac{75}{165}$
15 $11\times7=0\frac{77}{165}$
$18\frac{163}{165}$ Ans

From 7 weks
Take $9\frac{7}{10}$ days
Rem. 5 w. 4 d. 7 h. 12 mi

24
7
10)168
16 : 48

w	D	H	M
7	0	0	0
0	9	16	48
5	4	7	12 Ans

H
24
7
10)168
16,8
60
min 48.0

7)9
1 .. 2 days

W	D	H	M
7 ..	0 ..	00 ..	00
1 ..	2 ..	16 ..	48 ..
5 ..	4 ..	7 ..	12 Ans

L L S S S S B

Multiplication of Vulgar fraction

Section 4.

1. Multiply $\frac{2}{3}$ by $\frac{1}{4}$.

$\frac{2\times1=2}{3\times4=12}=\frac{1}{6}$ Ans

2. Multiply $4\frac{1}{2}$ by $\frac{1}{8}$.

$4\frac{1}{2}$
2

$\frac{9\times1=9}{2\times8=16}$ Ans.

3. Multiply $\frac{3}{8}$ by $\frac{4}{5}$. Ans $\frac{3}{10}$

$\frac{3\times4=\ 12=3}{8\times5=\ 40=10}$ Ans

4. Multiply $\frac{2}{5}$ of $\frac{3}{4}$ by $\frac{1}{2}$ Ans $\frac{3}{20}$

$\frac{2}{5}$ of $\frac{3}{4}$ (2) $\frac{6}{20}=\frac{3}{10}$

$\frac{3\times1=3}{10\times2=20}$ Ans

5. Multiply $7\frac{1}{2}$ by $\frac{1}{4}$. Ans $1\frac{7}{8}$

$7\frac{1}{2}$
2

$\frac{15\times1=15}{2\times4=8}$ $)15(1\frac{7}{8}$ Ans
8
$\frac{7}{8}$

6. Multiply $\frac{3}{4}$ of 9 by $\frac{7}{8}$. Ans $5\frac{29}{32}$

9
3
4)24
6 : $\frac{3}{4}$

$27\times7=189$
$4\times8=32)189(5\frac{29}{32}$ Ans
160
$\frac{29}{32}$

7. Multiply $48\frac{3}{5}$ by $13\frac{5}{6}$. Ans $672\frac{3}{10}$

$48\frac{3}{5}$

$243\times83=20169$
$5\times6=30)20169(672\frac{3}{10}$ Ans
180
216
210
69
60
$3)\frac{9}{30}=\frac{3}{10}$ Ans

Division of Vulgar Fractions — James McCormick

1. Divide $\frac{3}{5}$ by $\frac{2}{3}$.

$\frac{3\times3}{5\times2}=\frac{9}{10}$ Ans

2. Divide $4\frac{1}{2}$ by $1\frac{2}{3}$.

$4\frac{1}{2}$, $1\frac{2}{3}$ — $\frac{9}{2}$, $\frac{5}{3}$ — Ans $\frac{9\times3}{2\times5}=\frac{27}{10}=2\frac{7}{10}$

3. ~~Divide $\frac{14}{27}$ by $\frac{3}{5}$~~

3. Divide $\frac{3}{8}$ by $\frac{6}{7}$. Ans $\frac{21}{48}$

$3\times6=21$, $8\times7=48$ Ans

4. Divide $1\frac{1}{2}$ by $4\frac{8}{10}$ Ans $1\frac{22}{63}$

$\frac{17\times5}{21\times3}=\frac{85}{63}=1\frac{22}{63}$ Ans

5. Divide $\frac{7}{8}$ by 4. Ans $\frac{5}{16}$

$1\frac{1}{2}$, $4\frac{8}{10}$ — $\frac{3\times1}{2}$, $\frac{48}{10}$ — $=\frac{30}{96}=\frac{5}{16}$ Ans

6. Divide $\frac{7}{8}$ by 4. Ans $\frac{7}{32}$

$\frac{7\times1}{8\times4}=\frac{7}{32}$ Ans

7. Divide $9\frac{1}{6}$ by $\frac{1}{2}$ of 7. Ans $2\frac{13}{21}$

$9\frac{1}{6}$ — $55\times2=110$

2)7 — $3\frac{1}{2}$ — $\frac{7}{2}$

$6\times7=42)110(2\frac{13}{21}$ Ans
84
$2)\frac{26}{42}=\frac{13}{21}$

8. Divide $5205\frac{1}{5}$ by $\frac{4}{5}$ of 91. Ans $71\frac{1}{2}$

91 × 4 — 5)364 — $72\frac{4}{5}$ — $\frac{364}{5}$

$5205\frac{1}{5}$ — $\frac{26026\times5}{5\times364}$

130130
1820)130130($71\frac{1}{2}$ Ans
12740
2730
1820
$910)\frac{910}{1820}=\frac{1}{2}$

The Rule of Three In Vulgar Fractions

Sections. ſſſ

1. If $\frac{1}{4}$ of a yard of cloth cost $\frac{2}{3}$ of a dolllar what will $\frac{7}{8}$ of a yard come to:

Yd D Yd

$\frac{4}{1} : \frac{2}{3} : : \frac{7}{8} : \frac{56}{24}$ $2\frac{1}{3}$ Ans

2. If $\frac{2}{3}$ of a ton of iron cost $16\frac{4}{3}$ dollars, what will $\frac{6}{7}$ of a ton come to: Ans. 211 dollars. $28\frac{12}{21}$ cts.

T D T

$\frac{2}{3} : 16\frac{4}{3} : : \frac{6}{7}$

$\frac{3}{2} \times \frac{493}{3} \times \frac{6}{7}$

493
3
1479
6

42)8874(211,28$\frac{12}{21}$ Ans

2)$\frac{24}{42}$($\frac{12}{21}$

3. A person having $\frac{3}{4}$ of a coal mine, sells $\frac{3}{4}$ of his share for 171 dollars, what is the value of the whole mine at the same rate:

Ans. 380 dollars.

$\frac{3}{4}$ of $\frac{3}{5} = \frac{9}{20} : \frac{171}{1} : : \frac{1}{1}$

171
20
9)3420
380 dollars Ans

4. At $\frac{5}{6}$ of a dollars per yard what will 42 yards come to: Ans 35 dollars.

$\frac{5}{6} : \frac{42}{1} : : \frac{1}{1}$

6)210
35 Ans.

5. A gentleman owing $\frac{2}{5}$ of a vessel, sells $\frac{2}{3}$ of his share for 312 dollars, what is the whole vessel worth: Ans. 1170 dollars.

$\frac{2}{5}$ $\frac{2}{3}$ $\frac{4}{15} : \frac{312}{1} : : \frac{1}{1}$

312
15
1560
312
4)4680
1170 Ans

6. If $1\frac{1}{3}$ bushels of apples cost $79\frac{1}{3}$ cents, what will $3\frac{2}{5}$ bushels cost at the same rate: Ans $202\frac{3}{10}$ cents.

$\frac{1\frac{1}{3}}{4}$. $\frac{79\frac{1}{3}}{238}$ . . $\frac{3\frac{2}{5}}{17}$

3 . 3 × 5

238
17
1666
238
4046
3
6(0)12138
202 : $\frac{18}{60} = \frac{3}{10}$ Ans

in the place 3

7 If $\frac{1}{8}$ of a ship be worth 175 dollars 35 cents, what part of her may be purchased for 601 dollars 20 cents: Ans. $\frac{3}{4}$

$\frac{175,35}{1} : \frac{1}{8} :: \frac{601,20}{1}$

$20040)\frac{60120}{140280} = \frac{3}{4}$ Ans

$60120)140280(2$
120240
20040

Inverse Proportion.

§§§ Section 7. §§§

1 How much shalloon $\frac{3}{4}$ yards wide, will line $4\frac{1}{2}$ yards of cloth $1\frac{1}{2}$ yards wide.

$1\frac{1}{2} = \frac{3}{2}$ thon as $\frac{3}{2} : \frac{9}{2} :: \frac{3}{4}$

$4\frac{1}{2} = \frac{9}{2}$

Or inverted $\frac{3}{2} : \frac{9}{2} :: \frac{4}{3} = \frac{108}{12} = 9$ Ans

2. If $6\frac{1}{2}$ hundred weight be carried $22\frac{9}{26}$ miles for $25\frac{3}{4}$ dollars, how far may 1 hundred weight be carried for the same money: Ans. $145\frac{1}{4}$ miles.

cwt $6\frac{1}{2}$: M $22\frac{9}{26}$ :: cwt 1

13   144   44

$\frac{13}{2} : \frac{581}{26} :: \frac{1}{1}$

2   52

581
13
1743
581
$52)7553(145\frac{1}{4}$ Ans
52
235
208
273
260
$13)\frac{13}{52} = \frac{1}{4}$

3. If 12 men can finish a piece of work in $37\frac{3}{5}$ days; how long will it take 16 men to do the same work: Ans. $28\frac{1}{5}$ days.

$37\frac{3}{5}$

$\frac{12}{1} : \frac{188}{5} :: \frac{16}{1}$

16
80
5
80

188
12
$2256(28\frac{1}{5}$ Ans
160
656
640
$16)\frac{16}{80} = \frac{1}{5}$

4. A lends to B $100\frac{2}{3}$ dollars for $6\frac{2}{3}$ months: what sum should B lend to A for $3\frac{5}{6}$ years, to requite his kindness. Ans. $14\frac{122}{207}$ dol

M $\frac{6\frac{2}{3}}{20}$: D $100\frac{2}{3}$: years $3\frac{5}{6}$

3   $\frac{302}{3}$ 12 $\frac{46}{1}$ Months

302
20
$414)6040(14\frac{122}{207}$ Ans
414
1900
1656
$2)\frac{244}{414}\frac{122}{207}$

46
3
138
3
414

5. How many feet long must a board be that is $\frac{7}{8}$ of a foot wide to equal one that is $20\frac{1}{2}$ feet long and $\frac{3}{4}$ of a foot wide:

Ans. $17\frac{4}{7}$ feet long.

$\frac{3}{4}$: $20\frac{1}{2}$: $\frac{7}{8}$

41 × 3 = 328 ... 984 ÷ 56 = $17\frac{4}{7}$ Ans

6. In exchanging $20\frac{1}{2}$ yards of cloth of $1\frac{1}{4}$ yard wide for some of the same quality of $\frac{3}{4}$ yards wide, what quantity of the latter makes an equal barter: Ans. $34\frac{1}{6}$ yards.

$1\frac{1}{4}$ = $\frac{5}{4}$: $20\frac{1}{2}$ = $\frac{41}{2}$: $\frac{3}{4}$

164 × 5 = 820 ÷ 24 = $34\frac{1}{6}$ Ans.

Of Involution or The raising of Powers

§§§ Section 1. §§§

1. What is the 3d power of 15:

15×15×15=3375 Ans.

```
     15
     15
     75
    15
    225
     15
   1125
   225
   3375 Ans
```

2. What is the 4th power of 35:

Ans. 1500625.

```
        35
        35
       175
      105
      1225
        35
      6125
     3675
     42875
        35
    214375
   128625
   1500625 Ans.
```

3. What is the 3d power of 1.03:

Ans. 1.092727.

```
     1.03
     1.03
     3 09
    1030
    1.0609
      1.03
    3.1827
   106090
   1.092727 Ans
```

4. What is the 5th power of .029: Ans. .000000707281.

```
          .029
          .029
           261
           58
       .000841
          .029
          7569
         1682
      .00024389
           .029
        219501
        48778
  .000000707281 Ans
```

5. What is the 4th power of $\frac{3}{4}$:

Ans. $\frac{81}{256}$

$3\times3\times3\times3=81$

$4\times4\times4\times4=256$ Ans

The Square Root

Section 3.

1. What is the squre root of 531441

```
531441 (729 Ans.
49          729
142) 414    6561
     284    1458
1449) 13041 5103
      13041 531441 proof.
```

2. What is the square root of 106929: Ans. 327.

```
106929(327 Ans
9
62) 169
    124
647) 4529
     4529
```

3. What is the square root of 4782969: Ans. 2187.

```
4782969(2187 Ans.
4
41) 78
    41
428) 3729
     3424
4367) 30569
      30569
```

4. What is the square root of 43046721: Ans. 6561.

```
43046721(6561 Ans
36
125) 704
     625
1306) 7967
      7836
13121) 13121
       13121
```

5 What is the square root of 387420489: Ans. 19683.

```
387420489(19683 Ans
1
29) 287
    261
386) 2642
     2316
3928) 32604
      31424
39363) 118089
       118089
```

6 What is the square root of 22071204 4698. Ans.

```
22071204(4698 Ans
16
86) 607
    516
929) 9112
     8361
9388) 75104
      75104
```

7. What is the square root of 36372961: Ans. 6031.

```
36372961(6031 Ans
36
1203) 3729
      3609
12061) 12061
       12061
```

J. T. S.
2

The Square Root

8. What is the square root of 2268741: Ans. 1506.23+

```
      2268741(1506.23+ Ans
      1
25)   126
      125
3006)   18741
        18036
30122)   70500
         60244
301243)  1025600
          903729
          121871
```

9. What is the square root of 7596796: Ans. 2756.228+

```
         7596796(2756.228+ Ans
         4
47)      359
         329
545)     3067
         2725
5506)    34296
         33036
55122)   126000
         110244
551242)  1575600
         1102484
5512448) 47311600
         44099584
          3212016
```

10 What is the square root of 9712.718051 Ans. 98.553+

```
        9712.718051(98.553+ Ans
        81
188)    1612
        1504
1965)   10871
         9825
19705)  104680
         98525
197103) 615551
        591309
         24242
```

11. What is the square root of 3.1721812. Ans. 1.78106+

```
         3.17218120(1.78106+ Ans
         1
27)      217
         189
348)     2821
         2784
3561)    3781
         3561
356206)  2202000
         2137236
           64764
```

12. What is the square root of 4795.25731. Ans. 69.247+

```
         4795257310(69.247+ Ans
         36
129)     1195
         1161
1382)    3425
         2764
13844)   66173
         55376
138487)  1079710
          969299
          110411
```

Square Root James McCormick

13. What is the square root of .00007836. Ans. .0088+

$$
\begin{array}{l}
.00\,00\,78\,36(.0088 \text{ Ans} \\
\quad 64 \\
168)\,1436 \\
\quad\;\; 1344
\end{array}
$$

Examples.

1. What is the square root of $\frac{2304}{5184}$. Ans. $\frac{2}{3}$

$$576)\frac{2304}{5184}\left(\frac{4}{9}\right.$$

$$\frac{4}{9} \;\; \frac{2}{3} \text{ Ans}$$

2. What is the square root of $\frac{2704}{4225}$. Ans. $\frac{4}{5}$

$$169)\frac{2704}{4225} = \frac{16}{25}$$

$$\frac{16}{25} \;\; \frac{4}{5} \text{ Ans}$$

3. What is the square root of $\frac{15625}{46656}$. Ans. $\frac{125}{216}$

$$
\begin{array}{l}
15625(125 \\
1 \\
22)\,56 \\
\quad\; 44 \\
245)\,1225 \\
\quad\;\; 1225
\end{array}
\qquad \frac{125}{216} \text{ Ans}
$$

$$
\begin{array}{l}
46656(216 \\
4 \\
41)\,66 \\
\quad\; 41 \\
426)\,2556 \\
\quad\;\; 2556
\end{array}
$$

Surds.

4. What is the square root of $\frac{357}{476}$. Ans. .86602+

$$
\begin{array}{l}
476)\,3570(.75 \\
\quad\; 3332 \\
\quad\;\; 2380 \\
\quad\;\; 2380
\end{array}
$$

$$
\begin{array}{l}
.75(.86602+ \text{ Ans} \\
\; 64 \\
166)\,1100 \\
\quad\;\; 996 \\
1726)\,10400 \\
\quad\quad 10356 \\
173202)\,440000 \\
\quad\quad 346404 \\
\quad\quad\; 93596
\end{array}
$$

Squa(r)e Root James McCormick

5. What is the square root of $\frac{478}{549}$. Ans. .93308+

870673952 6(.933094+ Ans
81
18,3)606
549
186,3)5773
5589
186609)18495 26
1679481
1400145

6. What is the square root of $\frac{387}{738}$. Ans. 72414+ Ans.

52439024 39(72414+ Ans.
49
14,2)343
284
1444)5990
5776
14481)21424
14481
144824)694339
579296
115043

Examples.

1. What is the square root of $37\frac{36}{49}$. Ans. $6\frac{1}{7}$.

$37\frac{36}{49}$
339
151
1849
49(7
49

1849(43/7) 43(6 1/7 Ans
16
(83)249
249
42
1/7

2. What is the square root of $27\frac{9}{16}$. Ans. $5\frac{1}{4}$.

$27\frac{9}{16}$
171
27
441
16(4
16

441(21/4) 21(5 1/4 Ans
4
41)41
41
20
1/4

3. What is the square root of $51\frac{21}{25}$. Ans. $7\frac{1}{5}$.

$51\frac{21}{25}$
256
104
1296
25(5
25

1296(36/5) 36(7 1/5 Ans
9
6,6)396
396
35
1/5

4. What is the square root of $9\frac{43}{49}$. Ans. $3\frac{1}{7}$.

$9\frac{43}{49}$
84
40
484
49(7
49

484(22/7) 22(3 1/7 Ans
4
4,2)84
84
21
1/7

Square Root James McCormick

Surds.

5. What is the square root of $7\frac{9}{11}$ Ans. 2.7961+

$$7\frac{9}{11}$$

11)86
7.81818 18 18 9(2.7961+ Ans
4
4,7)381
329
54,9)5281
4941
558,6)34081
33516
5592,1)56581
55921
760

6. What is the square root of $8\frac{5}{7}$: Ans 2.9519+

$$8\frac{5}{7}$$

7)61
8.71428571(2.9519+ Ans
4
4,9)471
441
58,5)3042
2925
590.1)11785
5901
5902,9)588471
531261
57210

7. What is the square root of $85\frac{14}{15}$: Ans. 9.27+

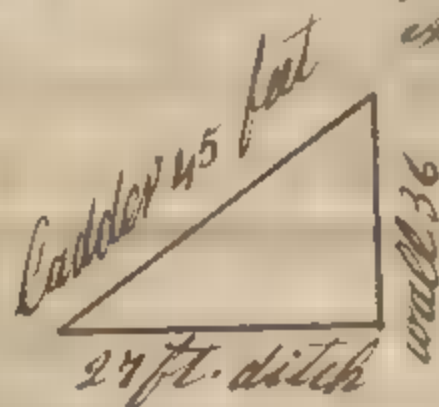
$$85\frac{14}{15}$$

15
429
86
15)1289(85.9333(9.27+ Ans
81
18,2)493
364
184,7)12933
12929

Square Root — James McCormick

Example.

1. The wall of a fortrass is 36 feet high and the ditch before it is 27 feet wide. it is required to find the length of a ladder that will reach to the top of the wall from the opposite side of the dich: Ans. 45 feet.

Ladder 45 feet — wall 36 — 27 ft. ditch

```
    36
    36
   216
  108
  1296
   729
  20.25(45 Ans.
  16
8.5)425
    425
```

```
 27
 27
189
54
729
```

2. The top of a castle from the ground is 45 yards high. and is surrounded with a ditch 60 yards broad. what length must a cable be to reach from the outside of the ditch to the top of the castle: Ans. 75 yards.

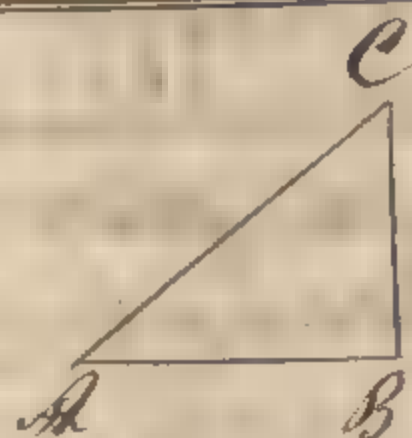
```
    45
    45
   225
  180
  2025
  3600
  56.25(75 Ans.
  49
14,5)725
     725
```

```
  60
  60
3600
```

3. In a right angled triangle. A B C. the hypothenuse line A C is 45 feet. the base A B 27 feet; required the length of the perpendicular line B C: Ans. 36 feet.

```
   45
   45
  225
 180
 2025
  729
 12.96(36 Ans.
 9
6,6)396
    396
```

```
 27
 27
189
54
729
```

C — A — B

4. In the right angled triangle A B C. the line A C is 75 feet. B C 45 feet: required the length of the line A B; Ans. 60 feet.

```
   75
   75
  375
 525
 56.25(
 20.25
 36.00(60 Ans
 36
12) 0000
```

```
   45
   45
  225
 180
 2025
```

Square Root

Examples

1. If the content of a given circle be 160. what is the side of the square equal. Ans. 12,64911+

```
      160(12,64911+ Ans.
      1
 2,2)60
     44
 24,6)1600
      1476
 252,4)12400
       10096
 2528,9)230400
        227601
 25298,1)279900
         252981
 252982,1)2691900
          2529821
           162079
```

2. If the area of a circle be 2025, what is the side of the square equal. Ans. 45

```
     2025(45 Ans.
     16
 8,5)425
     425
```

3. If the area of a circle be 750. what is the side of the square equal: Ans. 27.38612+

```
      750(27.38612+Ans
      4
 4,7)350
     329
 54,3)2100
      1629
 546,8)47100
       43744
 5476,6)335600
        328596
 54772,1)700400
         547721
 547722,2)15267900
          10954444
           4313456
```

Examples

1. There is a circle whose diameter is 4 feet; what is the dimater of one 4 times as large Ans. 8 feet.

```
   4
   4
  16
   4
  64(8 Ans.
  64
```

2. A has a circular yard of 100 feet diameter: but wishes to enlarge it to one of 3 times that area; what will the diameter of the enlarged one measure. Ans. 173.2+

```
    100
    100
  10000
      3
  30000(
  1
 2,7)200
     189
 34,3)1100
      1029
 346,2)7100
       6924
        176
```

3. If the diameter of a circle be 12 inches, what will be the diameter of another circle of half the size. Ans. 8.48+ inches.

```
     12
     12
  2)144
     72(8.48
     64
 16,8)800
      660
 168,8)14000
       13504
         496
```

Square Square Root

1. What 1. When the area is 160 what is the diameter. Ans. 14.2729474

```
 160(12.64911+
22)60
   44
246)1600
    1476
2524)12400
     10096
25289)230400
      227601
252981)279900
       252981
2529821)2691900
        2529821
```

```
          12.64911+
           1.12837
          8854377
         3794733
       10119288
       2529822
      1264911
     1264911
     14.2728762507 Ans
```

```
          12.64911+
           1.12837
          8854377
         3794733
       10119288
       2529822
      1264911
     1264911
2)14.2728762507
   7.1364. Ans  Answer
```

Aplication.

1. If an army of 20736 men is formed into a square colum; how many men will each front contain: Ans. 144 men.

```
 20736(144 Ans.
24)107
    96
284)1136
    1136
```

2. What length of a halter will be sufficient to fasten a horse from a post in the centre so that he may be able to graze upon an acre of grass and no more: Ans. 7.1364 perches or Or 117ft. 9 inches.

```
 160(12.64911+
22)60
   44
246)1600
    1476
2524)12400
     10096
25289)230400
      227601
252981)279900
       252981
2529821)2691900
        2529821
```

2. How many feet of boards will it require to lay the floor of a roo that is 25 feet square: Ans. 625 feet

```
 25
 25
125
50
625. Ans.
```

Square Root James McMinick

3. A certain square pavement contains 197136 square stones all of the same size; how many are contained in one of its sides: Ans. 444.

197136(444 Ans.

4. In a triangular piece of ground containing 600 perches one of the shortest sides measures 40 perches and the other 30: what is the length of the longest side. Ans. 50 perches.

5. Two gentlemen set out from Pittsburgh at the same time: one of them travels 84 miles due north, and the other 50 miles due west: what distance are they asunder: Ans. 97¾ miles.

97.75. Ans

6. What is the square root of 964.5192360241: Ans. 31.05671.

964.5192360241(31.05671. Ans.

7. What is the square root of 1030892198.4001. Ans. 32107.51.

1030892198.4001(32107.51. Ans.

Last

Cube Root

1. What is the cube root of 48228544 (364 Ans.

'48228544
the greatest cube in 48 = 27
square of 3×3 = 27.36 | 21228
add 540 | 19656
compl divisor 3276 | 1572544
| 1572544
2 and defect D. 388816
add 4320
2 and complet D. 393136

3
3
9
3
27

6
3
18
30
540

36
36
216
108
1296
3
3888

36
4
144
30
4320

2. What is the cube root of 13824 Ans. 24

13824 (24 Ans.
8
1216 | 5824
240 | 5824
1456

2
2
4
3
12

4
2
8
30
240

3. What is the cube root of 373248: Ans. 72.

373248 (72 Ans
343
14704 | 30248
420 | 30248
15124

7
7
49
7
343

7
7
49
3
147

7
2
14
30
420

2529.

Cube Root Cube R

4. What is the cube root of 5735339. Ans. 179.

```
          5735339(179 Ans
          1
 349    |4735
 210    |3913
 559    |  822339
86781   |  822339
 4590
91371
```

5. What is the cube root of 84604519: Ans. 439

```
        84604519(439. Ans.
        64
  4809 |20604
   360 |15507
  5169 |  5097519
 554781|  5097519
  11610
 566391
```

~~5. What is the cube root of 84604519.~~

6. What is the cube root of 27054036008. Ans. 3002.

```
          27054036008(3002 Ans
          27
27000004 |    54036008
   18000 |    54036008
27018004
```

7. What is the cube root of 122615327232. Ans. 4968.

```
          122615327232(4968 Ans.
          64
   4881  |58615
   1080  |53649
   5961  |  4966327
 720336  |  4374936
   8820  |    591391232
 729156  |    591391232
73804864
  119040
73923904
```

Cube Root

8. What is the cube root of 22069810125. Ans. 2805

```
                 22069810125(2805 Ans.
                  8
     1264 |14069
      480 |13952
     1744 |       117810125
 23520025 |       117810125
    42000
  2356?025
```

9. What is the cube root of 219365327791. Ans. 6031.

```
                 219365327791(6031 Ans
                 216
     1080009 | 3365327
        5400 | 3256227
     1085409 |         109100791
   109082401 |         109100791
       18090
   109100791
```

10. What is the cube root of 673373097125. Ans 8765.

```
                 673373097125(8765 Ans
                 512
     19249 |161373
      1680 |146503
     20929 |      14870097
   2270736 |      13718376
     15660 |              1151721125
   2286396 |              1151721125
 230212825
    131400
 23[illegible]4225
```

11. What is the cube root of 12.977875. Ans. 2.35

```
                 12.977875(235 Ans
                  8
     1209 |4977
      180 |4167
     1389 |     810875
   158725 |     810875
     3450
   162175
```

Cube Root James

12. What is the cube root of 15926.972504 Ans 25.16 +

```
          15926.972504(25.16 + Ans.
          8
   1225 | 7926
    300 | 7625
   1525 |  301972
 187501 |  188251
    750 |
 188251 |  113421504
18900336|  113673096
   45180|      48408
18945516|
```

13. What is the cube root of 36155.027576 Ans. 33,06+

```
          36155.027576(33.06+ Ans.
          27
   2709 | 9155
    270 | 8937
   2979 | 
32670036|  218027576
   59400|  196376616
32729436|   21650960
```

14. What is the cube root of 053258279. Ans. 376+

```
          .053258279(376+ Ans.
          27
   2749 | 26258
    630 | 23653
   3379 | 2605279
 410736 | 2504576
   6660 |  100903
 417396 |
```

15. What is the cube root of .001906624 Ans. 124

```
          001906624(124 Ans
   304  | 906
    60  | 728
   364  | 178624
 43216  | 178624
  1440  |
 44656  |
```

Cube Root

16. What is the cube root of ,000000729. Ans. ,009

,000000729(,009 Ans.
729

17. What is the cube root of 2. Ans. 1.25+

2(1.25 Ans.
1

309	1000
60	738
369	262000
43225	225125
1800	36875
45025	

Cube Root

James McCormick

Cube Root Root

2. What is the cube root of $12\frac{19}{27}$. Ans. $2\frac{1}{3}$

12 19
27 27
93
25
343
27

343(7
343

27(3)7(2 1/3 Ans.
24
1
3

2. What is the cube root of $405\frac{28}{125}$. Ans. $7\frac{2}{5}$

405 28
125 125
2033
812
405
50653
125

50653(37
27
2749 | 23653
630 | 23653
3379 |

125(5)37(7 2/5 Ans.
125
35
2
5

Surds.

4. What is the cube root of $7\frac{1}{5}$. Ans. 1.93+

5)1.0
7.200 (1.93 Ans
1
381 | 6200
270 | 5859
651 | 341000
110709 | 341000
1710 | 337257
112419 | 3743

5. What is the cube root of $8\frac{5}{7}$. 2.057+ Ans.

7)5.00
8.714285714(2.057+ Ans
8
120025 | 714285
3000 | 615125
123025 | 99160714
12607549 | 88554193
43050 | 1060 6521
12650599

6. What is the cube root of $9\frac{1}{6}$. 2.092 + Ans

6)1.00
9.166666666(2.092+ Ans.
8
120081 | 1166666
5400 | 1129329
125481 | 37337666
13104304 | 26233688
12540 | 11103978
13116844

Cube Root James McCormick

Examples.

1. If the solid content of a gobe is 10648. what is the side of a cube of equal solidity. Ans. 22.

10648(22 Ans.
8
1204 | 2648
120 | 2648
1324

2. If the solid content of a globe is 389017. what is the side of a cube of equal solidity Ans. 73.

389017(73 Ans
343
14709 | 46017
630 | 46017
15339

Examples.

1. There is a cubical vessel whose side is two feet; I demand the side of another vessel which shall contain three times as much. Ans. 2 feet 10 inches and 1/5 nearly.

in
24
24
96
48
576
24
2304
1152
13824 inches
3
41472(34.6 ans
27
2716 | 14472
360 | 12304
3076 | 2168000
346836 | 2117736
6120 | 50264
352956

12)34.6
2.10, 3/5 inches

2. There is a cubical vessel whose side is 1 foot. require the side of another vessel that shall contain three times as much. Ans. 17.306 inches.

in
12
12
144
12
1728
3
5184(17.306 in. ans
1
349 | 4184
210 | 3913
559 | 271000
86709 | 264717
1530 | 6283000000
88239 | 5389088616
897870036 | 893911384
311400
898181436

Cube Root

Application.

1. If a ball of 6 inches diameter weigh 32 lb. what will one of the same metal weigh. whose diameter is 3 inches. Ans. 4 lb.

in 6
6
36
6
216 : 32 :: 27

in 3
3
9
3
27
32
54
81
216)864(4 lb. Ans.
864

2. What is the side of a cubical mound equal to one 288 feet long. 216 broad. and 48 high. Ans. 144 feet.

288
216
1728
288
576
62208
48
497664
248832
2985984(144 feet Ans.
1
316 | 1985
12 | 1744
436 | 241984
58816 | 241984
1680
60496

3. There is a stone of a cubic form. which contains 389017 solid feet: what is the superficial content of one of its sides. Ans. 5329 feet.

389017
389017
2723119
389017
3501153
3112136
1167051
151334226289(5329 feet Ans.
125
7509 | 26334
450 | 23877
7959 | 2457226
842704 | 1691768
3180 | 765458289
845884 | 765458289
84907281
143640
85050921

Cube Root

4. What is the difference between half a solid foot and a solid half foot. Ans. 3 half feet.

```
        12
        12
       144         6
        12         6
  2)1728          36
     864           6
     216         216
216)648(3 Ans.
    648
```

5. In a cubical foot how many cubes of 6 inches and how many of 4 are contained therein. A. 8 of 6 inches and 27 of 4 inches.

```
   6
   6
  36      216)1728(8 of 6 inches
   6          1728
 216

   4
   4
  16      64)1728(27 of 4 inches
   4          128
  64          448
              448
```

2. What is the cube root of 13824. Ans. 24

```
        13824(24 Ans.
         8
1216 |5824
 240 |5824
1456

                24
                24
                96
               48
               576
                24
              2304
             1152
             13824
```

Proof Proof

Progression James. McCormick

§§ Case 1. §§

1. A merchant bought 50 yards of linen. at 2 cents for the first yard. 4 for the second. 6 for the third. &c. increasing two cents every yard. what was the price of the last yard. how much the whole amount. and what the average price per yard.

2 4 6

```
          50 number of terms less one
           1
Multiply  49
           2 common differince
          98
add        2 first term
         100 Last term
           2 first term
         102 sum of the two extremes
          50 number of terms
     2)5100
    50)2550 Sum of all the terms
         51 cents per yard
```

Ans { 100 cents the last yard; 25 50 do the whole amount; 50 do the average price per yard }

2. Bought 20 yards calico at 3 cents for the first yard. 6 for the second. 9 for the third. &c: what did the whole cost. Ans. 6 dolls. 30 cents.

3 6 9

```
        20
         1
        19
         3
        57
add      3
        60 last
         3
        63
        20
   2)1260
      630 Ans
```

Progression

3. If 100 apples were laid two yards distant from each other in a right line, and a basket placed two yards distant from the first apple, what distance must a person travel to gather them singly into the basket: Ans. 11 miles 3 furlongs 180 yards.

4 8 16

```
      100
        1
       99
        4
      396
        4
      400
        4
      404
      100
   2)40400
1760)20200( 11 miles
     1760
   )2600(
    1760
220)840( 3 furlongs
    660
    180 yards
```

4. A agreed to serve B 10 years at the rate of 20 dollars for the first year, 30 for the second, 40 for the third &c. what had he the last year, how much for the whole time, and what per annum. Ans. 110 dolls. for the last year; 650 dolls. the whole amount, and 65 dolls. per annum.

1 2 3
20 30 40

```
     19
      9
     10
     90
     20
    110 last
     20 first term
    130
     10
  2)1300
 10)650  Ans.
     65 per annum.
```

5. A sold to B 1000 acres of land at 10 cents for the first acre, 20 for the second, 30 for the third &c; what was the price of the last acre, and what did the whole come to

Ans. { 100 dolls. the last acre / 50050 do. whole cost

1 2 3
10 20 30

```
     1000
        1
      999
       10
     9990
       10
    10000 last terme
       10
    10010
     1000
  2)10010000
    5005000
```

Ans. { 100 dolls. the last acre / 50050 do. whole cost.

Progression Progressio

§§§ Case 2. §§§ 1. A is to receive from B a certain sum to be paid in 11 several payments in arithmetical progression; the first payment to be 20 dollars. and the last to be 100 dollars; what is the common difference, what was each payment, and how much the whole debt

Operation.

100 last term
20 first term
No. of terms 11−1=10) 80 the difference

8 common difference

20+100×5½=660
20 first payment
20+8=28 second do.
28+8=36 third do. &c.

2. There are 21 persons whose ages are equally distant from each other in arithmetick progression; the youngest is 20 years old. and the oldest 60; what is the common difference of their ages. and the age of each man;

60
20
21−1=20) 40
2 commen difference
20+60×10½=1200
20 first payment

Ans. { 2 common difference
20+2=22 the second
22+2=24 the third. &c.

Ans. { 20+2=22 second do.
22+2=24 the third. &c.

3. A man is to travel from pittsburgh to a certain place in 12 days. and is to go but 3 miles the first day. increasing each days journey in arithmetical progression, making the last days travelling 58 miles; what is the daily increase. and what the whole distance.

Ans. { 5 miles daily increase
366 miles whole distance.

58
3
12−1=11) 55
7 common difference
3
2) 10
5 miles daily increase

3+58×6=366 miles. whole distance

Geometrical Progression

Example. 111 1. Suppose 20 yards of broadcloth was sold at 4 mills for the first yard, 12 for the second, 36 for the third, &c. what did the cloth come to and what was gained by the sale, supposing the prime cost to have been 15 dollars per yard:

```
          P  P  P  P
Indices 1  2  3  4
Ratio   3  9  27 81
                 81
                 81
                648
               6561 = the 8th power
               6561
              6561
            39366
           32805
          39366
         43046721 = 16th power
               27 = 3d power
       301327047
       86093442
       1162261467 = 19th power
               x4 first term
       4649045868 = 20th or last term
               x3 ratio
       13947137604
               -4 first term
Ratio 3-1=2)13947137600
      dolls. 6973568.800   first cost of the cloth
                300 00
          6973268.80 gain.
```

2. A father gave his daughter who was married on the first day of January one dollar towards her portion, promising to double it on the first day of every month for one year; what was the amount of her whole portion. Ans. 4095 dollars.

Geometrical Progression

```
 1  2  3  4  5
 2  4  8 16 32
            32
            64
          96
        1024
           2
        2048
           2
        4096
           1
        4095  Ans
```

3. A merchant sold 15 yards of satin; the first yard for 1s. the second for 2s. the third for 4s. &c. in geometrical progression; what was the price of the 15 yards. Ans. 1638£. 7s.

```
 1  2  3  4  5
 2  4  8 16 32
            32
            64
          96
        1024
          16
        6144
       1024
       16384
           2
       32768
           1
   20)3276(7  Ans
```

4. A goldsmith sold 1 pound of gold at 1 cent for the first ounce. 4 for the second. 16 for the third. &c. what did it come to. and what did he gain. supposing he gave 20 dolls per ounce. Ans. he sold it for 55924 dollars 5 cents. and gained 55684 dolls 5 cents.

```
 1  2  3   4
 4 16 64 256
         256
        1536
       1280
       512
       65536
          64
      262144
     393216
     4194304
           4
    16777216
           1
 4-1=3)16777215
     55924.05
       240.00
     55684.05   Ans
```

Geometrical Progression

5. What sum would purchase a horse with 4 showes and 8 nails in each shoe at 1 mill for the first nail 2 mills for the second 4 mills for the third &c doubling in geometrical progression to the last. Ans. 4294967 dolls. 29 cts 5 mills.

```
 1 2 3  4  5  6   7    8
 2 4 8 16 32 64 128   256
                      256
                     1536
                    1280
                    512
                    65536
                       64
                   262144
                  393216
                  4194304
                       32
                  8388608
                12582912
                134217728
                       16
               805306368
              134217728
              2147483648
                        2
              4294967296
                        1
              4294967295 Ans.
```

6. What sum would purchase the same horse with the same number of shoes and nails at 1 mill for the first nail 4 for the second 16 for the third &c in a quadruple ratio of geometrical progression to the last. Ans. 42651094425 dolls 92 cts

```
 1 2  3  4   5   6    7    8
 3 9 27 81 243 729 2187 6561
                        6561
                        6561
                      39366
                     32805
                    39366
                    43046721
                         729
                   387420489
                   86093442
                  301327047
                  31381059609
                          243
                   94143178827
                 125524238436
                 62762119218
```

Geometrical Progression

```
          7625597484987
                     81
          7625597484987
        61004779879896
        617673396283947
                      3
     18 530201885184 1
                      1
3-1=2) 18530201885184 0
        926510094425922.0   Ans.
```

Ans

7. What sum would purchase the same horse, with the same number of shoes and nails, at 1 mill for the first nail, 4 for the second, 16 for the third, &c. in a quadruple ratio of geometrical progression to the last: Ans. 614891469123651 7 dolls. 20 cts. 5 mls.

```
1   2    3     4      5       6       7       8
4 . 16 . 64 . 256 . 1024 . 4096 . 16384 . 65536
                                          65536
                                         393216
                                        196608
                                       327680
                                      327680
                                     393216
                                     4294967296
                                           4096
                                    25769803776
                                   38654705664
                                 17179869184 0
                                 17592186044416
                                           1024
                               70368744177664
                              35184372088832
                            17592186044416 0
                            18014398509481984
                                          256
                          108086391056891904
                         90071992547409920
                       36028797018963968
                       4611686018427387904
                                         4
                      18446744073709551616
                                         1
4-1=3) 18446744073709551615
        6148914691236517,20.5   Ans
```

Geometrical Progression

P. Sold 30 yards of silk velvet. at 2 pins for the first yard. 6 for the second. 18 for the third. &c. and these disposeed of at 1000 for a farthing; what did the issuet amount to; and what was gained by the sale. supposeing the prime cost to have been 100l. per yard:

Ans. { Amount 2144699929l.5s.3½d
Gained 2144669929l.5s.3½d }

1 . 2 . 3 . 4 . 5 . 6 . 7

3 . 9 . 27 . 81 . 243 . 729 . 2187

2187

15309

17496

2187

4374

4782969

4782969

43046721

28697814

43046721

38263752

33480783

19131876

22876792454961

3

68630377364883

2

137260754729766

3

411782264189298

2

3−1=2) 411782264189296

4) 205891132094648

12) 51472783023−2

20) 4289398585=3

2144699929−5=3½d

3000

2144669929−5=3½d Ans.

Position   Position
Sames

∫∫∫ Examples. ∫∫∫

1. A school master being asked how many scholars he had, said if I had as many, half as many, and one quarter as many more, I should have 132: how many had he:

Operation

Suppose he had 40
as many 40
½ as many 20
¼ as many 10
110 : 40 :: 132 : 48 Ans.

proof 48
48
24
12
132

2. It is required to divide a certain sum of money among 4 persons in such a manner that the first shall have ⅓, the second ¼, the third ⅙, and the fourth the remainder which is 28 dolls: what was the sum.

Suppose 72
⅓ is 24
¼ is 18
⅙ is 12
54
Error 18 : 72 :: 28 : 112 Ans. 112 dolls.

proof 112
⅓ is 37⅓
¼ is 28
⅙ is 18⅔
84
28 last share.

3. A. B. and C. buy a carriage for 340 dollars, of which A pays three times as much as B and B four times as much as C: what did each pay.

Ans. { A paid 240 dolls.
B 80
C 20

5
20
60
85 : 5 :: 340
5
85)1700(20 C.s
170 4
0 80 B.s
3
240 A.s Ans.

Position

4. What is the sum of which $\frac{1}{4}$, $\frac{1}{5}$ and $\frac{1}{6}$ make 148 dollars:
Ans. 240 dolls.

60
$\frac{1}{4}$ is 15
$\frac{1}{5}$ is 12
$\frac{1}{6}$ is 10
37 : 60 : : 148
60
37)8880(240 Ans.
74
148
148
0

5. A person having spent $\frac{1}{2}$ and $\frac{1}{3}$ of his money had $26\frac{2}{3}$ dolls. left: what had he at first: Ans. 160 dolls.

36
$\frac{1}{2}$ is 18
$\frac{1}{3}$ is 12
30
6 : 36 : : $26\frac{2}{3}$
$26\frac{2}{3}$
216
72
24
6)960
160 Ans.

36
2
3)72
24

6. A. B. and C. talking of their ages. B said his age was once and a half the age of A: C said his was twice and one-tenth the age of both and that the sum of their ages was 93: what was the age of each:

A 20
20
$\frac{1}{2}$ 10
B 30
20
50
2
100
5
105
30
20
155

155 : 20 : : 93
20
155)1860(12 A's 12 Ans
155
310
310

12
$1\frac{1}{2}$
12
6
B's 18 Ans
12
30
$2\frac{1}{10}$
60
3
C's 63 Ans

Position

7. Seven-eights of a certain number exceeds four fifths by 6: what is that number: Ans. 80

```
   16          16
    7           4
8)112       5)64
   14         12.8
   12.8
    1.2 : 16 : : 6
          6
1.2)96.0(80 Ans
    96
     0
```

8. A gentleman bought a chaise horse and harness for 360 dollars: the horse came to twice the price of the harness and the chaise to twice the price of the horse and harness together: what did he give for each:

Ans. { 80 dolls. for the horse / 40 harness / 240 Chaise }

```
 10
  1
 10
 10
 20
 10
 30
  2
 60
 20
 10
 90 : 10 : : 360
               10
    90)3600(40
       360
         0
```

```
Harness  40 Harness
          2
         80 Horse
         40
        120
          2
        240 Chase
```

9. A gentleman being asked the price of his carriage answered that 1/3, 1/4, 1/5 and 1/6 of its price was 228 dollars: what was the price of the carriage: Ans. 240 dollars.

```
      60
1/3 is 20
1/4 is 15
1/5 is 12
1/6 is 10
       57 : 60 : : 228
                    60
   57)13680(240 Ans
      114
       228
       228
         0
```

10. A saves 1/3 of his wages. but B who has the same salary, by spending twice as much as A. sinks 50 dollars a year: what is their annual salary: Ans. 150 dolls each

```
     30
1/3 is 10 : 30 : : 50
                   30
       10)1500(150 Ans.
          10
           50
           50
            0
```

Double Position

1. A father leaves his estate to be divided among his three sons: A. B. and C. in the following manner: viz. A is to have one half wanting 50 dollars. B one third. and C 10 dolls. less than B: what was the sum left. and what was each son's share:

Operation.

1st. Suppose 240 dollars.

then 240 ÷ 2 − 50 = 70 A's part
240 ÷ — 3 = 80 B's part
B's share 80 — 10 = 70 C's part

Sum of all the part 220
 | 24
 | 20 er. too little.

2d. Suppose 300 dollars.

~~then 300 dollars.~~

then 300 ÷ 2 − 50 = 100 A's part
300 ÷ 3 = 100 B's part
B's share − 10 = 90 C's part
290
10 er. too little.

errors

1st. sup. 240 ╳ 20 = 6000

2d. sup. 300 ╳ 10 = 2400

10) 3600 (360 Ans.

proof 360 ÷ 2 − 50 = 130
÷ 3 = 120
− 10 = 110
360 Ans.

---

2. A and B have the same income: A saves the ⅛ of his. but B by spending 30 dollars per annum more than A. at the end of 8 years finds himself 40 dollars in debt what is their income. and how much does each spend per annum:

Ans. { Their income is 200 doll's. per ann.
A spends 175
B spends 205 }

Double Position

4. A. B. and C. built a house which cost 10000 dollars: A paid a certain sum. B paid 1000 dollars more than A. and C paid as much as both A and B: how much did each one pay

Ans { A paid 2000 dolls. B 3000 C 5000 }

```
 10000            10000
    10               20
  1000             1000
  1010             1020
    10               20
  1020             1040
  1020             1040
  2040             2080

 10000            10000
  2040             2080
  7960 err     err 7920 errors.
  7920
    40

      10 \    / 7960
          \  /
           \/
           /\
  7960    /  \   7920
    20   /    \    10
159200          79200
 79200
40)80000( A's
  2000
  1000
  3000  B's
  2000
  5000  C's
```

5. A gentleman has 2 horses. and a saddle worth 50 dollars. which saddle if he put on the back of the first horse will make his value double that of the second: but if he put it on the second horse. it will make his value triple that of the first: what is the value of each horse:

Ans { First horse 30 dolls. Second do. 40 }

```
  20      35        50       50
  50      50        50       50
  70      85       100      100
  40      60        50      150
  60 err  25       150  err  50
          50
          75

      20 \    / 25
          \  /
           \/
           /\
   25     /  \    50
   50    /    \   20
 1250          1000
 1000
75)2250(30 horse
  225     50
         2)80
           40 horse
```

```
sup. 20    sup. 50    sup.
  35                  50
  50                  50
  85                 100
20×3=60      50×3=  150
Error 25              50

   20 \  / 25
  25   \/
  50   /\  50      + 75
 1250      20
 1000    1000
75)2250(  30 horse
   2250     50
            80
          2)40 horse
```

Double Position

6. The head of a fish is 9 inches long. and its tail is as long as its head and half its body. and its body is as long as its head and tail together: what is its whole length   Ans. 6 feet.

1st Suppose

12 boady
6 half the boady
9 the head
15 the tail
9 head
24
12
err 12
6
6

2)24
12
9
21
9
30
24
err 6

12 × 12
6

24 × 12 = 288
6 × 12 = 72
288 − 72 = 216
6)216 = 36
36 + 18 = 54 (reading partly uncertain)

12)72
6 feet Ans.

---

7. A laborer hired 40 days upon this condition. that he should receive 20 cents for every day he wrought. and forfeit 10 cents for every day he was idle: at settlement he received 5 dollars: how many days did he work. and how many was he idle: Ans. wrought 30 days. idle 10.

worked
34
20
680
60
6.20
5
err 1.20 +

40
34
6 idle
10
60

worked
24
20
480
160
err 2.20
5
1.80
120
300

40
24
16 idle
10
160

34 × 1.20
1.80 (uncertain)

24
120
480
24
2880

34
720
540
6120
2880

3.00)9000
30 days
20
6.00
1.00
5.00 received

40
30 worked
10 idle
10
1.00 forfeit

Double Position

8. A and B vested equal sums in trade A gained a sum equal to $\frac{1}{4}$ of his stock; and B lost 225 dollars. then A's money was double that of B's: what sum had each vested:

Ans. 600 dolls.

$$\begin{array}{r} 4)500 \\ 125 \\ \hline 625 \\ 550 \\ \hline \text{err } 75- \end{array} \quad \begin{array}{r} 500 \\ 225 \\ \hline 275 \\ 2 \\ \hline 550 \end{array} \quad \begin{array}{r} 4)800 \\ 200 \\ \hline 1000 \end{array} \quad \begin{array}{r} 800 \\ 225 \\ \hline 575 \\ 2 \\ \hline 1150 \\ 1000 \\ \hline 150 \text{ err} \\ 75 \\ \hline 225 \end{array}$$

500 ╳ 75

75 / 150

$$\begin{array}{r} 75 \\ 800 \\ \hline 60000 \\ 75000 \end{array} \quad \begin{array}{r} 150 \\ 500 \\ \hline 75000 \end{array}$$

225)135000(600 answer
1350
00

9. Divide 15 into two such parts. so that when the greater is multiplied by 4. and the less by 16. the products will be equal:

Ans. greater 12. less 3.

$$\begin{array}{r} 10 \\ 4 \\ \hline 40 \end{array} \quad \begin{array}{r} 5 \\ 16 \\ \hline 80 \\ 40 \\ \hline \text{err } 40 \end{array} \quad \begin{array}{r} 9 \\ 4 \\ \hline 36 \end{array} \quad \begin{array}{r} 6 \\ 16 \\ \hline 96 \\ 36 \\ \hline \text{err } 60 \\ 40 \\ \hline 20 \end{array}$$

10 ╳ 40

9 / 60

$$\begin{array}{r} 9 \\ 40 \\ \hline 360 \end{array} \quad \begin{array}{r} 60 \\ 10 \\ \hline 600 \\ 360 \\ \hline 2(0)24(0 \\ 12 \\ 4 \\ \hline 48 \end{array} \quad \begin{array}{r} 3 \\ 16 \\ \hline 48 \end{array}$$ Ans.

10. A person being asked in the afternoon. what o.clock it was. answered that the time past from noon was equal to $\frac{2}{13}$ of the time to midnight: what o.clock was it

Ans. 36 minutes past 10 o.clock

H M
3 .. 00
1 .. 23 $\frac{1}{13}$
1 .. 36 $\frac{12}{13}$
60
96
13
290
97
1260 err

H M
5 .. 00
1 .. 04 $\frac{8}{13}$
3 .. 55 $\frac{5}{13}$
60
235
13
710
235
3060 err
1260
1800

3 × 1260
1260 × 5 = 6300
3060 × 3 = 9180
6300
1800)2880(1
1800
1080
60
64800(36
5400
10800
10800

Permutation James Morm

Examples

1. In how many different positions may 5 persons be placed at a talable. 1×2×3×4×5=120 Ans.

2. How many changes may be rung on 12 bells. and how long would they be ringing but once over: allowing 10 changes to be rung in one minute. and the year to contain 365 days and 6 hours: Ans. 479001600 changes. and would require 91 years 3 weeks. 5 days. and 6 hours.

1
2
2
3
6
4
24
5
120
6
720
7
5040
8
40320
9

Permutation
James M^cCormick

```
        362880
            10
       3628800
            11
      39916800
            12
   10)479001600
   6(0)47900160
      798336(91 Years
365.6 : 1 :: 78894
  24          9396
  1466        8766
  730          630
  8766.0    4  365¼ one fourth of a day
               3150
              2750
            1990
              157.5   7
         230107.5(   26
          175320      3.5.6
         547875       w d H
         525960
          21915
             24
          87660
         43830
         525960
         525960
```

3. Seven men not agreeing with the owner of a boarding house about the price of boarding offer to give 100 dollars each. for as long time as they can seat them selves every day differently at dinner: this offer being accepted. how long may they stay: Ans. 5040 days. or 13 years. 295 days.

```
          1
          2
          2
          3
          6
          4
         24
          5
        120
          6
        720
          7
365)5040(13 Years
    365
    1390
    1095
     295 days
```

4. What number of variations will the nine digits admit of: Ans. 362880.

```
  1          5040
  2             8
  2         40320
  3             9
  6        362880 Ans
  4
 24
  5
120
  6
720
  7
```

~~Permutation~~

Combination.

Examples

1. How many combinations may be made of 7 dollars out of 12:

```
   1                12
   2                11
   2               ----
   3               132
   6                10
   4              ----
  24              1320
   5                 9
 120              ----
   6             11880
 720                 8
   7             -----
5040             95040
                     7
                ------
                665280
                     6
5040)3991680(792 Ans.
     35280
     -----
      46368
      45360
      -----
       10080
       10080
```

Duodecimals

Examples

ft.	in	″	‴	⁗
25	9	3	5	8
34	3	9	2	7
28	10	4	8	4
64	11	9	7	2
82	7	5	6	8
15	3	7	9	10
44	6	11	2	8
22	3	6	1	5
318	8	9	5	4

ft.	in.	″	‴	⁗
2446	3	10	5	
3559	8	5	1	
5591	11	9	5	8
129	5	5	6	9
895	11	0	5	11
651	1	7	5	9
555	9	8	5	5
388	11	10	10	9
32112	9	4	7	9
30610	3	0	9	4
32112	9	4	7	9

Subtraction of Duodecimals.

Rule.

	ft.	in.	″	‴	⁗
From	125	4	8	8	2
Take	68	[illegible]	2	10	1
Rem.	56	7	0	10	1	Ans.

ft.	in.	″	‴	⁗
2756	5	7	8	0
1839	9	5	11	10
916	8	1	8	2
2756	5	7	8	0

3. From a board measuring 35 feet 9 inches 2 seconds. cut 24 feet. 11 inches 5 seconds. and 4 thirds; what is left.

Ans. 10ft 10in. 8 sec. 8th.

ft	in	″	‴
35	9	2	0
24	10	5	4
10	10	8	8	Ans.

4. A Joiner having lined several rooms very ~~neatly~~ curiously with costly materials. finds the amount to be in square measure 803 feet. 3 inches. 4 seconds. but several deductions being to be made for windows. arches. &c these deductions amounted to 70 feet. 3 inches. 7 seconds. 10 thirds. 5 fourths: how many feet of workmanship must he be paid for.

Ans. 732 ft. 11in. 8″ 1‴ 7⁗.

ft	in	″	‴	⁗
803	3	4	0	0
70	3	7	10	5
732.	11.	8.	1.	7	Ans.

Multiplication of Duodecimals

Case 1.

1. Multiply 8.6.9 (ft in ″) by 7.3 (ft in)

```
ft  in  ″  ″
8 .. 6 .. 9
       7 .. 3
59 .. 11 .. 3
 2 .. 1 .. 8 .. 3
62 .. 0 .. 11 .. 3   Ans.
```

```
12|3          12|9
   7.25       12|6.75
                 8.5625
                  7.25
                428125
               171250
              599375
proof         62.078125
                     12
               0.937500
                     12
              11.250000
                     12
               3.000000
```

2. Multiply 9 5 (ft. in) by 3 11 (ft in) Ans 36.10.7 (ft in ″)

```
ft  in
9 .. 5
     3 .. 11
 8 .. 7 .. 7
28    3
36 .. 10 .. 7   Ans.
```

3. Multiply 7 .. 10 (ft) by 8.11 (ft. in.) Ans. 56.10 7 (ft in. ″)

```
ft  in
7 .. 10
      8 .. 11
7 .. 2 .. 2
62 .. 8
69 .. 10 .. 2   Ans.
```

4. Multiply 8.11.6 by 2.7.4 Ans. 21.10.5

```
ft  in  ″
8 .. 11 .. 6
        2 .. 7 .. 4
   2 .. 9 .. 6 .. 0
      .. 4 .. 6
11 .. 10
16 .. 9 .. 0
21 .. 10 .. 5 .. 0  0   Ans.
```

5. What is the price of a marble slab. whose length is 5 feet 7 inches. and breadth 1 foot 10 inches ~~and breadth 1 foot~~ at 1 dollar and 50 cents per foot

Ans. 15 dolls. 31½ cts

```
ft  in ..
5 .. 7
     1 .. 10
4 .. 7 .. 10
5    7
$ 6
1 : 1.50 :: 10 .. 2 .. 10
12          12
12          122
144          12
           1474
            150
          73700
         1474
144)221100(15.35 ans.
    144
     771
     720
      510
      432
       780
       720
   . 12)60(5/12
       144
```

Multiplication of Duodecimals

6. There is a house with three tiers of windows. 3 in a tier. the height of the first tier is 7 feet 10 inches. of the second 6 feet 8 inches. and of the third 5 feet 11 inches. and the breadth of each window is 3 feet 11 inches: what will the glazeing come to at 14 cents per foot: Ans. 32 dolls. 62½ cts.

```
 ft   in
 7 .. 10
      3 .. 11
 7    2    2
23    6
30    8    2
           3
92    0    6

 ft   in
 6 .. 8
      3 .. 11
 6    1    4
20    0
26    1    4
           3
78    4   0

 ft   in
 5 .. 11
      3 .. 11
 4   10    8
16    0
20   10    8
           3
62    8    0
78    4    0
92    0    6
233   0    6
```

```
 1
12  : 14 : : 233.0 .. 6
12              12
144           2796
                12
             33558
                14
            134232
             33558        ent
144)        469812 ( 32.62
            432
             378
             288
              901
              864
               372
               288
           12) 84 = 7
              144 = 12
```

Case 2

1. Multiply 84 feet 6 inches. by 36 feet 7 inches and 6 seconds.

Operation.

```
          84 · 6
             6×6=36
         507 · 0
             6
6in  |1/2| 3042 · 0
1    |1/12|  42  3
6sec |1/6|        7
                3  6
Ans.  3094   9
```

2 multiply 76 ft 7 in by 19 ft 10 in Ans. 1518 ft 10 in 11

```
  ft   in          ft
  76   7
       6×3+1=19
 459   6
       3
1378   6
  76   7
6in |1/2| 1455   1
4   |1/3|   38   3
    |1/3|   25   6   6
                     4
1518  10  10   Ans.
```

3. multiply 127 ft 6 in by [illegible] ft in Ans. 11772 6

```
  ft   in
 127   6
      12×7+8=92
1530   0
       7
10710  0
1020   0
11in |1/3| 11730  0
             42   6
11772  6
```

4. multiply 184.8 by 127.6 Ans 23545

```
 ft   in
184   8 × 7
        10
1846  8 × 2
        10
18466  8
 3693  4
 1292  8
6in |1/2| 23452  8
             92  4
23545   0  Ans
```

Multiplication of Duodecimals.

5. multiply 311 ft 11 in 7 sec. by 36 ft 7 in 5 sec

6×6=36

1868.3.6

6

11209.9.0

155.8.3.6

259.8.4

8.4.2.10.11

219.8.7

11402 0.0 7 11 Ans

6. A floor is 70 feet 8 inches by 38 feet 11 inches; how many square feet are therein: Ans. 2750 ft. 1 in. 11 sec.

ft in
70 8
6×6−2=38

424 0
6
2544 0
141 4

6in 2685 4
4in 35 4
1 23 6 8
11in 510 8

2750.1.11 Ans.

7. If a ceiling be 59 feet 9 inches long and 24 feet 6 inches broad. how many yards does it contain:

Ans. 162 yds. 5 ft 10½ in

ft in
59 9
6×4=24

358 6
4
6in 1434 0
29 10 6

1463 10 6

9) 162 yds. 5 ft 10½ in Ans

8. What will the paving of a court yard come to at 15 cents per yard. the length being 58 feet 6 inches. and the breadth 54 feet 9 inches

Ans. 53 dolls. 38+cts.

ft in
58 6
9×6=54

526 6
6
6in 3159 0
3 29 3
111 7 6

9) 3202 10 6
355 7 10½

Yards : 15 :: Yards 355 ft 7 in 10½
9
3202
12
38434
2
76868
15

384340
76868

216) 1153020 (533.8+cts
1080

730
648

822
648

1740
1728

12

9. What is the solid content of a bale of goods. measuring in length 7 feet 6 inches. breadth 3 feet 3 inches. and depth 1 foot 10 inches. Ans. 44 ft 8 in. 3 sec

Multiplication of Duodecimals.

```
 ft  in
 7 .. 6
    3 .. 3
 22  6
  1  10  6
 24  4  6
        1 .. 10
 24  4  6
 20  3  9  0
 44 .. 8 .. 3 .. 0  Ans.
```

10. A merchant imports from London six bales of the following dimensions. viz What are the solid contents. and how much will the freight amount to. at 20 dollars per ton of 40 feet.

Ans. 71 ft. 7 in. and freight 35 dolls. 79 cts.

```
2 .. 10          2 .. 10          3 .. 6           2 .. 10
   2 .. 4          2 .. 6          2 .. 2           2 .. 8
0  11  4         1  5  0          0  7  0          1  10  8
5  8             5  8             7  0             5  8
6  7  4          7  1  0          7  7  0          7  6  8
      1 .. 9          1 .. 3          1 .. 8          1 .. 9
4  11  6  0      1  9  3  0       5  0  8  0       5  8  0  0
6  7  4          7  1  0          7  7  0          7  6  8
11  6  10  0     8  10  3  0      12  7  8  0      13  2  8  0

                                  2 .. 10          2 .. 11
                                     2 .. 6           2 .. 8
                                  1  5  0          1  11  8
                                  5  8             5  10
                                  7  1  0          7  9  4
                                       1 .. 9          1 .. 8
                                  5  3  9  0       5  2  2  8
                                  7  1  0          7  9  4
                                  12  4  9  0      12 .. 11 .. 6 .. 8   6
                                                   12 .. 4 .. 9 .. 0    5
                                                   13 .. 2 .. 8 .. 0    4
                                                   12 .. 7 .. 8 .. 0    3
                                                   8 .. 10 .. 3 .. 0    2
                                                   11 .. 6 .. 10        1
                                                   71 .. 7 .. 8 .. 8

40 : 20 :: 71 .. 7 .. 8 .. 8
12          12
480         859
             20
480)17180(35.79  Ans.
    1440
     2780
     2400
      3800
      3360
       4400
       4320
     8)  80 = 1
        480   6
```

Multiplication of Duodecimals.

Examples.

1. The length of a single decked vessel is 60 feet. the breadth 20. and depth 10; what is the tonnage.

```
     60
     20
   1200
     10
95)12000(126 6/19 tons Ans
   95
   250
   190
    600
    570
  5)30=6
    95=19
```

2. Required the tonnage of a double decked vessel whose length is 90. and breadth 30.

```
     90
     30
   2700
     15
  13500
  2700
   
95)40500(426 6/19 tons Ans.
   380
    250
    190
     600
     570
  5)30=6
    95=19
```

3. A single decked vessel is 64 feet long. 22 feet broad. and 10 feet deep: what is its tonnage. Ans. 148 4/19 tons

```
     64
     22
    128
   128
   1408
     10
95)14080(148 4/19 tonage Ans.
   95
   458
   380
    780
    760
  5)20=4
    95=19
```

4. What will be the tonnage of a double decked vessel whose length is 80 feet. and breadth 26 feet. A. 284 12/19 tons.

```
     80
     26
    480
   160
   2080
     13
   6240
  2080
95)27040(284 12/19 tons Ans.
   190
    804
    760
     440
     380
  5)60=12
    95=19
```

Carpenters or Sliding Rule

Measuring of Boards and Timber

Examples

1. Required to find a fourth proportional to 12, 28. and 114
Set the first term 12 on B. to the second term 28. on A: then against the third term 114 on B. stan stands 266 on A. which is the fourth proportional sought.

12 : 28 : : 114
28
912
228
12)3192(266 Ans.
24
79
72
72
72

2. Required the fourth proportional term to the numbers 25 : 75 : : 100. Ans. 300.

25 : 75 : : 100
100
25)7500(300 Ans.
75
00

3. Required the fourth proportional term to the numbers 27 : 20 : : 73

27 : 20 : : 73 Ans. $54\frac{2}{27}$
20
27)1460($54\frac{2}{27}$
135
110
108
$\frac{2}{27}$

Examples

1. Required the square root of 400.
Set 1 upon C to 10 upon D: then against the number 400 on C stands its root 20 on D.

2. Required the square root of 529. Ans. 23.

529(23. Ans.
4
43)129
129

3. What is the square root of 900 Ans. 30

900(30 Ans
9
6)00

4. What is the square root of 300. Ans. 17.3+

300(17.3+ Ans.
1
27)200
189
343)1100
1029
71

Measuring of Boards and Timber

Section. 3.

1. How many feet are there in a board that is 13 feet long and 16 inches broad:

By Duodecimals. Decimals.

Operation.

ft	in
13	0
1	4
13	0
4	4 0
17	4 0 Ans.

13.
1.33
39
39
13
17.29 Ans

2. Required the superficies of a board whose mean breadth is 1 foot 2 inches and length 12 feet 6 inches:

~~Ans. 3 dolls. 9½ cts~~
Ans. 14 feet 7 inches.

ft	in
12 .. 6	
	1 .. 2
12	1 0
12	6
14	7 0 Ans.

3. Required the value of 5 oaken planks at 3 cents per foot; each of them being 17½ feet long and their several breadths as following viz. two of 13½ inches in the middle one of 14½ inches in the middle and the two remaining ones each 18 inches at the broader end and 11¼ inches at the narrower:

Ans. 3 dolls. 9½ cts

in 13½, 13½, 14½ = 41½
in 18, 18 = 36; 22½; 2)58½ = 29¼; 41½; 70.9"
in 11¼, 11¼ = 22½

70.9"
4×4+1=17
2830
4
11300
709
6 in ½ | 1200.9 ... 35.4..6
ft 6 : 3 : 1236..1..6
12
14833
12
178002
3
1728)534006(309 Ans.
5184
15606
15552
54
54)1728 = 54 = 1/32

Examples.

1. How many inches in length will it require to make one foot of a board that is 9 inches broad. Operation 144 ÷ 9 = 16 inches the length required.

2. How many inches in length of a board that is 23 inches wide will make 1 foot: Ans. 6.26+ inches

23)144(6.26+ Ans.
138
60
46
140
138
2

Measuring of Boards and Timber.

3. From a mahogany plank 26 inches broad. a yard and a half (or 13 feet 6 inches) is required to be cut off: what distance from the end must the line be struck: Ans. 74.7692 inches. or 6.23 feet

```
      13..6
      12
26)162(6.23 Ans.
   156
     60
     52
      80
      78
       2
```

∫∫∫ Examples ∫∫∫

1. If a piece of timber be 2 feet 9 inches deep. and 1 feet 4 inches broad. and the length 16 feet 9 inches. (or which is the same thing. if the quarter girt be 26 inches and the length 16 feet 9 inches) how many solid feet are contained therein:

Operation.

```
26 inches quarter girt 16.75 = 16 feet 9 inches the length
                      676
                    10050
                   11725
                  10050
          144)11323.00(78.63 + feet ans.
              1008
               1243
               1152
                 910
                 864
                  460
                  432
                   28 Rem
```

2. The quarter girt of a piece of squared timber is 15 inches. and the length 18 feet: required the solidity. Ans. 28⅛ feet.

```
      in
      15
      15
      75
     15
     225
      18
    1800
    225
144)4050(28⅛ feet Ans.
    288
    1170
    1152
18) 18/144 = 1/8
```

3. If a piece of squared timber be 15 inches square at the greater end. and 9 inches square at the greater end. and 9 inches square at the less and the length be 20 feet: what is the solid content: Ans. 40.13 feet.

```
      in
      25
       9
   2)34
     17
     17
    289
     20
144)5780(40.13 Ans.
    576
     200
     144
      560
      432
      128 Remainder
```

4. Suppose a piece of squared timber to measure 32 by 20 inches at the greater end and 16 by 6 inches at the less. and the length 18 feet: how many feet of timber are contained therein. Ans. 34.12 + feet

Measuring of Boards and Timber

```
  2)32     2)16   2)26   2)26
    16       5      13     3
     5                3
   2 1               13
   1 3
   6 3
  21
  24 3
   1 8
 2 1 5 4
 2 7 3
144)4 9 1 4(34.12 + feet Ans.
    4 3 2
     5 9 4
     5 7 6
       1 8 0
       1 4 4
         3 6 0
         2 8 8
           7 2
```

Examples.

1. A piece of round timber being 9 feet 6 inches long and its mean quarter girt 42 inches: what is the content

```
Decimals        Duodecimals.
                ft. in.
  3.5 = 42      3. 6 = 42 inches.
                   3 6
                1  9 0
               10  6
               12  3 0
                   9 6
                6  1 6
              110  3
              116  4 6       Ans.
```

2. The length of a tree is 24 feet. its girt at the thicker end is 14 feet. and at the smaller end 2 feet: what is its content Ans. 96 feet.

```
    14
     2
  2)16
  4)8
    2
    2
    4
   24
   16
    8
   96 feet Ans.
```

3. If a piece of round timber 18 feet long. measure 96 inches in circumference or the quarter girt 24 inches; how many feet of timber does it contain: Ans. 72 feet.

```
     4)96
       24
       24
       96
      48
     576
      18
    46 08
    57 6
144)103 6 8(72 feet Ans.
    100 8
      2 8 8
      2 8 8
```

4. If a piece of round timber measure 11 feet 4 inches at the larger end, 2 feet 8 inches at the less. and its length 21 feet. how many feet of timber are contained therein. Ans. 64.31 feet

```
      ft  in
      11   4
       2   8
      14   0
  2)168
  4)84
     21
     21
     42
    441
     21
    441
    882
144)9261(64.31 feet Ans.
    864
     621
     576
      450
      432      180
               144
                36
```

5. Required the amount of three pieces of round timber measuring as follows viz.

The first 24 feet long and mean girt 8 feet
the second 14½ do do 3.15
the third 17¼ do do 6.28

Ans. 147.5 + feet.

```
19.8      24
 2         4
 2        96
 4

4)3.15
  7875
  7875
 55125
 6300
  551
   39
.62015
  14.5
310075
248060
62015
8.992175
42.519525
96.
147.501700

4)6.28
  1.57
  1.57
  1099
  785
 157
 2.4649
  17.25
 123245
 49298
172543
24649
42519525
```

Carpenters and Joiners Work.

Examples.

1. If a floor be 57 feet 3 inches long and 28 feet 6 inches broad. how many squares of flooring does it contain

By decimals.

```
ft  in
57  3=57.25
28  6=28. 5
      28625
     45800
    11450
100)1631.625
    16.31.625  Ans
```

2. Let a floor be 53 feet 6 inches long and 47 feet 9 inches broad. how many squares does it contain

Ans. 25 squars. 54 feet

```
  ft
  53.5
  47.75
  2675
 3745
3745
2140
100)2554.625  Ans.
```

Carpenters and Joiners Work

3. A floor being 36 feet 3 inches long and 16 feet 6 inches broad what will it cost at 4 dolls and 50 cents per square. Ans. 26 dolls. 91 cts.

```
    ft
   36.25
    16.5
   18125
  21750
  3625
  598.125
     4.50
  29906250
 2392500
100)2691.56250   Ans.
```

4. A room is 35 feet long and 30 feet wide; there is in it a fire place wich measures 6 feet by 4 feet 6 inches and a well hole for the stairs measures 10 feet 6 inches by 8 feet; what will the flooring come to at 3 dolls. and 75 cents per square

Ans. 35 dolls. 21 + cts.

```
  ft          ft      ft
  35           6     10.5
  30          4.5       8
100)1050       30     84.0
    1050      24
     111      27.0
     939      84.0
     375     111.0
    4695
   6573
  2817
  35.21.25   Ans.
```

5. How many squares are contained in a partition that is 82 feet 6 inches long and 12 feet 3 inches high

Ans. 10 squares and 10+ feet.

```
    ft
   82.5
   12.25
   4125
  1650
 1650
 825
100)10.10.625   Ans.
```

6. If a partition between 2 rooms be in length 91 feet 9 inches and its height 11 feet 3 inches; how many squares are contained in it and how much does it come to at 4 dollars and 50 cents per square: Ans. 10 squares 32 feet and costs 46 dolls 44 cts.

```
    ft
   91.75
   11.25
   45875
  18350
  9175
 9175
 1032.1875
      4.50
 516093750
 41287500
100)4644.843750   Ans
```

7. If a house within the walls be 44 feet 6 inches long and 18 feet 3 inches broad: how many squares of roofing will it contain allowing the roof to be the true pitch

Operation

Carpenters and Joiners Work

By Decimals.

ft 18.25 = ft in 18 3 the breadth
44.5 = 44.6 the length

9125
7300
7300

flat 812.125
half 406.62
÷100) 1218.187
sum 12.18+ Ans.

ft
40.5
20.5
2025
8100
2) 83025
41512.5
124537.5
2.25 Squares
622687.5
249075.0
249075.0
28.0208375 Ans.

8. What cost the roofing of a house at 7 dollars and 40 cents per square: the length within the walls being 52 feet 8 inches. and the breadth 30 feet 6 inches; the roof being of a true pitch. Ans. 33 dolls. 73 cts.

ft
52.67
30.5
26335
158010
2) 160.6435
80.32.17
240.9652
1.40
96386080
2409652
337.351280 Ans.

9. Suppose a house measures within the walls. 40 feet 6 inches in length. and 20 feet 6 inches in breadth. and the roof being a true pitch: how many squares of roofing does it contain. and how much will it cost at 2 dolls. 25 cents per square:
Ans. 12.45375 squares. and costs 28 dolls. 2+ cts.

10. If a room or wainscot. being girt downwards over the mouldings. be 15 feet 9 inches high. and 126 feet 3 inches in compass: how many yards does that room contain

Operation.
By Decimals.
126.25
15.75
63125
88375
63125
12625
9) 1988.4375
220.8 Ans. 220 yards 8 feet

11. If a room of wainscot be 16 feet 3 inches high. and the compass of the room 137 feet 6 inches: how many yards are contained in it:
Ans. 248 yards 2+ feet.

16.25
137.5
8125
11375
4875
1625
9) 2234.375
248.2+ Ans.

Carpenters and Joiners Work

12. If the window Shutters about a room be 69 feet 9 inches broad and 6 feet 3 inches high ~~a room be~~: how many yards are contained therein at work and half. Ans. 72.656 yards.

```
      ft
    69.75
     6.25
   34875
  13950
 41850
2)43593 75
 21796875
9)6539062
  72.656+ Ans
```

13. What will the wainscoting of a room come to at 80 cents per square yard; supposing the height of the room including the cornice and moulding be 12 feet 6 inches and the compass 83 feet 8 inches. three window shutters each 7 feet 8 inches by 3 feet 6 inches and the door 7 feet by 3 feet 6 inches. the shutters and door being worked on both sides are reckoned work and half.

Ans. 96 dolls. 60 2/3 cts.

```
 ft  in        ft in
  7  8          3 .5
     3             7
 23           24.5     ft
 2.5                  83.666
115                     12.5
46                   418330
57.5               1003992
24.5               10458250
2)820                 41
 41                10868 2 5
                          80
                 9)869460000
                    96,60 2/3 Ans.
```

Of Brick Layers Work.

Section 5.

1. If a wall be 72 feet 6 inches long and 19 feet 3 inches high and 5 bricks and a half thick: how many rods of brick work are contained therein when reduced to the standard thickness.

By Duodecimals.

ft. in
72 6
19 3
648
72
1368
15 .. 1 .. 6
9 .. 6
÷ 3)15351 10 6
272)5117 (18 rods.
2397
68)221 (3 quarters.
17 feet.

ft in
(12)114 — 72 .. 6 / 19 .. 3
9 .. 6

2. How many yards and rods of standard thickness are contained in a brick wall whose length is 57 feet 3 inches and height 24 feet 6 inches: the wall being 2½ bricks thick. Ans. 259.74 yards or 8.59+ rods.

ft in
57 3
24 6
228
114
1368
25 7 6
6
1402 .. 7 .. 6
5
3)7013 .. 1 .. 6
2337 .. 8 .. 8
12 | 8.
9)233772
259.74 y

(12)72 — 57 .. 3 / 24 .. 6
6

272)2337.72 (8.59 ans
2176
1617
1360
2572
2448
114

3. If a wall be 245 feet 9 inches long 16 feet 6 inches high and 2½ bricks thick: how many rods of brick work are contained therein when reduced to standard thickness

Ans 24 rods 3 quarters 24 feet

ft in
245 .. 9
16 .. 6
1470
245
3920
122 10 6
12
4054 10 6
5
3)20272 4 6
272)6757 (24 rods.
544
1317
1088
68)229 (3 quarters
204
25 feet

4. A triangle gable end is raised to the height of 15 feet above the wall of a house whose width is 45 feet and the thickness of the wall is 2½ bricks; required the content in rods at standard thickness thickness.

Ans. 24 rods 3 quarters 24 feet.

ft in
45
7 .. 6
315
22 .. 6
337 6
5
3)1686 .. 6
272)562 (2 rods.
544
18 feet.

Masons Work

§§§ Examples. §§§

1. If a wall be 97 feet 5 inches long. 18 feet 3 inches high and 2 feet 3 inches thick. how many solid feet and perches are contained therein: By Decimals.

```
         97.417
           1825
        487085
      194834
     779336
     97417
    177786025
          2.25
     888930125
    355572050
   355572050
   4000.1856625  Ans. Solidity
```

2. How many solid feet and perches are contained in a wall 53 feet 6 inches long. 12 feet 3 inches high and 2 feet thick: Ans. 1310.75 feet and 52.9595 rods.

```
        ft  in
        12.25
         53.5
        6125
       3675
      6125
      655375
           2
24.75)1310.750(52.9595 ans
      12375
        7325
        4950
        23750
        22275
         14750
         12375
          23750
          22275
           1475
```

```
rod
ft  in
16..6
12
198 inches in Bre
12
1584
198
12)3564
18)297
   24.75

ft
16½
18
128
16½
297
  12
144)3564(24.75
    288
     684
     576
     1080
```

3. If a wall be 107 feet 9 inches long and 20 feet 6 inches high. how many superficial feet are contained therein: Ans. 2208 feet 10 inches.

```
  ft  in
 107..9
  20..6
 2140
   53 10 6
   15
 2208 10 6   Ans.
```

4. If a wall be 112 feet 3 inches long and 16 feet 6 inches high: how many superficial rods: each 63 square feet. contained therein Ans. 29 rods 25 feet.

```
        ft  in
       112.25
         16.5
       56125
      67350
     11225
63000)1852.125(29 rods Ans
      126000
       592125
       567000
        25.125 feet
```

5. What is a marble slab worth. whose length is 5 feet 7 inches and breadth, 1 foot 10 inches. at 80 cents per foot superficial: Ans. 8 dolls. 19 cts.

```
      ft  in
      5..7..10
      5..7..11
 ft   4..7..10
1:80::10..2..10
12       12
12      122
12       12
144    1474
         80
144)117920(8.18 cts Ans.
    1152
     272
     144
     1280
     1152
      128
```

5. The length of a room is 14 feet 5 inches breadth 13 feet 2 inches and heig 9 feet 3 inches to the under side of the cornice with projects 5 inches from the wall on the upper part next the ceiling: required the quantity of rendered and plastering: there being no deductions but your one door the size whereof is 7 by 4 feet: Ans. 53 yds. 5 feet of rendering and 18 yds. 5 ft. ceiling

ft in
14 .. 5
2
28 . 10
26 . 4
55 . 2
9 3
495
13 .. 9 .. 6
1 6
51 0 .. 3 .. 6
28
9)482 3 6
53 .. 5 Ans.

ft in
13 .. 2
2
26 . 11
ft
17
4
28

ft in
13 . 7
12 11
156
4 .. 6 .. 4
7
9)167 6 4
18 .. 5 Ans.

6. The circular vaulted roof of a church measures 105 feet 6 inches in the arch and 275 feet 5 inches in length what will the plastering come to at 12 cents per yard: Ans. 387 dolls. 42 cts.

ft in
275.5
105.6
1375
2750
137 .. 8 .. 6
43.9
9 : 12 :: 29056 . 5 .. 6
12
108 348677
12 12
1296 4184130
12
1296)50209560(387.42 nearly Ans.
3888
11329
10368
9615
9072
5436
5184
2520
2592

7. What will the white washing of a room come to at 2 cents per yard allowing it to be 30 feet 6 inches long & 24 feet 9 inches broad and 10 feet high; no deductions being made for vacuities: Ans. 4 dolls. 13 1/4 cts.

30.5
2
61.0

24.75
2
49.50
61 0
110 50 10
110 5.00
754875

24.75
30.5
12375
74250
754.875

9 : 2 :: 1859.875
2
9.000)3719.750(4,13.3 Ans
36000
11975
9000
29750
27000
27500
27000
500

Pavers Work

Section 8.

1. What cost the paving of a street 225 feet 6 inches long and 60 feet 6 inches wide at 30 cents per square yard. By Duodecimals.

ft in
225.6
60.6
13500
112.9
30..9
÷9)13642..9
1515..7..9
30
45450 inches. 26 = the price of 4ft 9

2. What will the paving of a foot path come to at 28 cents per yard the length being 35 feet 4 inches and the breadth 8 feet 3 inches. Ans 9 dolls. 40cts.

ft in
35..4
8..3
280
8 10 0
2 8
9:28::291 6 0
12 12
108 3498
28
27984
6996
108)97944(90,6+ Ans
972
744
648
96

3. What cost the paving of a court yard a 38 cents per yard. the length being 27 feet 10 inches. and the breadth 14 feet 9 inches:

Ans. 17dolls.33¾ cts

27..10
14 9
108
27
20 10 6
11 8
9:38::410 6 6
12 12
108 4926
12
1296 59118
38
472944
177354
1296)2246484(1733.3+ Ans.
1296
9504
9072
4328
3888
4404
3888
5160
3888
1272

4. What will be the expense of paving a rectangular yard whose length is 63 feet and breadth 45 feet, in which there is laid a foot path 5 feet 3 inches broad running the whole length with broad stones at 36 cents a yard, the rest being paved with pebbles at 30 cents a yard: Ans 96 dolls 07½ cts

63
45
315
252
2835 00
330.75
9:30::2504.25
30
900)75127.50(8347.5
7200 1323
3127 9670.5 Ans.
2700
4275
3600
6750
6300
4500
4500

mistake

ft
5.25
63
1575
3150
9:36::330.75
36
198450
99225
900)11907.00(132.3
900
2907
2700
2070
1800
2700
2700

Painters Work

§§ Section 9. §§§ 1. How many yards of painting will a room contain which (being girt over the moul dings) is 16 feet 6 inches. and the compass of the room 97 feet 6 inches:

By Decimals.

ft. in
97 6 = 97.5
16 6 = 16.5
4875
5850
975
9)1608.75 feet
Yards 178.6.75

2. A gentleman had a room painted at 8½ cents per yard. the measure whereof is as follows. viz. the height 11 feet 7 inches. the compass 74 feet 10 inces. the door 7 feet 6 inches by 3 feet 9 inches: five window shutters. each 6 feet 8 inches by 3 feet 4 inches: the breaks in the windos 14 inches deep. and 8 feet high: the opening for the chimney 6 feet 9 inches by 5 feet. to be deducted. the shutters and door are painted on both sides. what will the whole come to: Ans. 10 dolls. 43 cts.

7.6
3.9
21
5 7.6
1 6
28.1.6
ft
6 9
5
33.9

ft in
74.10
11.7
74
43 7 10
9 2
866 9 10
111 1 4
28 1 6
46 8
1052 8 8
33 9
9)1018 11 8
113 1 11 8
8½
904
565
9.60.5 Ans

6.8
4
18
2.2.8
2
22.2.8
5
111.1.4

8
16
6.8
22 8
1.2
22.8
3 9.4
26.5.4
5
132.2.8 breaks

14
8
9.4
5
46.8 breaks

3. How many yards of painting are there in a room. the length where of is 20 feet. its breadth 14 feet 6 inches and height 10 feet 4 inches: deducting a fire place of 4 feet by 4 feet 11 inches. and two windows. each 6 feet by 3 feet 2 inches: Ans 73 2/27 yards.

20
2
40

14.6
2
29.0
40
69 0
10 4
690
23
713
55.4
9)657.8
73.8 = 2
12
108
4)108 = 27 Ans

ft in
4.4
4
17.4
ft
3.2
6
19.0
2
38.0
17.4
55.4

11. What cost the painting of a room at 8 cents per yard: its length being 24 feet 6 inches. its breadth 16 feet 3 inches. and height 12 feet 9 inches: also the door is 7 feet by 3 feet 6 inches. and the window shutters of two windows. each 7 feet 9 inches by 3 feet 6 inches. but the breaks of the windows themselves. are 8 feet 6 inches high and 1 foot 3 inches deep: deducting a fire-place of 5 feet by 5 feet 6 inches: Ans. 7 dolls. 41 + cts.

16..3
16..3
32..6

24..6
24..6 Length
49..0
32..6 breadth
81..6 Compass
12 9

Door 7..0 by 3..6
Windows 7..9 by 3..6
Breaks 8..6 by 1..3
Chimney 5..6 by 5..0

1296) 9996 (7
Ans. 7.41

Glaziers Work

§§§ Section 10. §§§

1. How many square feet are contained in a window. which is 4 feet 3 inches long. and 2 feet 9 inches broad:

By Dvodecimals.

ft. in
4..3
2..9
8..6
3..2..3
11..8..3 Ans.

2. If a window be 7 feet 3 inches high and 3 feet 5 inches broad. how many square feet of glazing are contained therein: Ans. 24 feet 9 inches.

7..3
3..5
21..9
3..0..3
24..9..3 Ans.

3. There is a house with three tiers of windows. 7 in a tier. the height of the first tier is 6 feet 11 inches. of the second. 5 feet 4 inches. and the third. 4 feet 3 inches: the breadth of each widow is 3 feet 6 inches: what will the glazing come to at 14½ cents per foot: Ans. 58 dolls. 61 cts.

6 .. 11
5 .. 4
4 .. 3
16 .. 6

3 .. 6
7
24 .. 6
16 .. 6
1 4 4
2 4
1 2 3
3

4 .. 3 | 6 .. 11 | 5 .. 4
7 | 7 | 7
29 .. 9 | 48 .. 5 | 37 .. 4
3 .. 6 | 3 .. 6 | 3 .. 6
14 .. 10 .. 6 | 24 .. 2 .. 6 | 18 .. 8
89 .. 3 | 145 .. 3 | 112 .. 0
104 .. 1 .. 6 | 169 .. 5 .. 6 | 130 .. 8

169 .. 5 .. 6
104 .. 1 .. 6
130 .. 8 .. 0
ft 404 .. 3

1 : 14½ :: 404
12
4 8 5 1
14½
1 9 4 0 4
4 8 5 1
2 4 2 5 . 5
12.0) 7 0 3 3 9 . 5 (58.61 Ans.

4. What will the glazing of a triangular sky light come to at 10 cents per foot. the base being 12 feet 6 inches long. and the perpendicular height 16 feet 9 inches: Ans. 10 dolls. 11 6¾ cts.

12 .. 6
8 .. 4 .. 6
100 0
4 .. 2
6 3

1 : 10 :: 104 8 3
12
1256
12
15075
10
144) 150750 (10.116 7/8 Ans.
144
675
576
990
864
126
144
21/24 = 7/8

5. What is the area of an elliptical fan light of 14 feet 6 inches in length. and 4 feet 9 inches in breadth: Ans. 68 feet 10 inches

14 .. 6
4 .. 9
58 0
10 .. 10 .. 6
68 .. 10 .. 6 Ans.

6. There is a house with three tiers of windows. and 9 in each tire: the height of the first tier is 7 feet 10 inches. of the second. 6 feet 8 inches. of the third. 5 feet 4 inches: what will the glazing come to at 14 cents per foot: Ans. 47 dolls. 87½ cts.

1st April

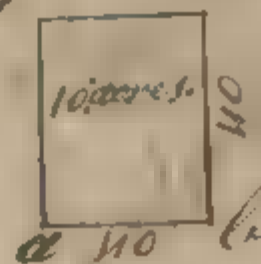
Measurement of Ground

Section 11.

1. In the square of a field. A. B. C. D. each side of which measures 40 rods or poles. how many acres:

Operation.

40
40
(40)1600
(4)40
10 Acres. Ans.

2. In a square field each side of which measures 35 two pole chains. how many acres: Ans. 30 acres 2 rood 20 perches.

3. A piece of square ground measures 16½ perches on each side: what is the content in acres. Ans. 1 acre 2 roods 32¼ perches.

Examples.

1. There is an oblong square piece of ground. A. B. C. D. the longest sides of which measure 64 perches. and the shortest sides. or ends. measure 40: how many acres does it contain.

Operation.

64 = the length
40 = the breadth
(40)2560
(4)64
16 Acres. Ans.

2. In a piece of ground lying in the forme of an oblong square. the length measures 120 perches and the breadth 84. what is its content in acres.

120
84
480
960
160)10080(63 Ans
960
480
480

Ans. 63 acres.

3. A lot of ground lying in the form of an oblong square. measures 240 feet in length and 120 in breadth: what is its content in acres: Ans. 0 acres 2 quarters 25 perches 213¾ feet.

30¼
9
272¼
4
1089

240
120
4800
240
28800
4
115200(105 perches
1089
630
545
4855
213¾

4. There is an oblong piece of ground whose length is 14 two polechains 25 links. and breadth 8 chains 37 links: how many acres does it contain:

8.37 = 17.48 breadth
14.25 = 29 length
15732
3496
4.0)50.692
4)12.26
3.0.26.92

nearly.

Ans. 3 acres 0 quarters 27 perches

5. An oblong piece of ground measures 17 two polechains and 21 links in length. and 15 chains 38 links in breadth: how many acres contained therein:

17.21
2
34.84

15.38
2
31.52

34.84
31.52
6968
17420
3484
10452
160.0000)1098.1568(6 acres
960.0000
4.0)138.1568
3.18

Rule.

1. let A.B.C. be a triangular piece of ground. the longest side or base B.C. is 24 chains 38 links and perpendicular A.D. 13 chains 28 links: how many acres does it contain

Operation.

ch. l.
24 38 = 49.52 perches
13 28 = 27.12
9904
4952
34664
9904
9824
1342
half 4.0)671.4912 perches
4)16.31
4031.4

Ans. 4 acres 0 rood 31.4 perches

2. In a triangular piece of ground. the base or longest side measures 75 perches. and the perpendicular 50: how many acres does it contain
Ans. 11 acres 2 ~~quart~~ qrs. 35 perches.

```
      75
      50
 2)3750
40)187.5
 4) 46.35
    11=2=35 Ans.
```

3. How many superficial yards are contained in a triangular piece of ground. the base of wich measures 120 perches. and the perpendicular 84 perches: Ans. 1417 dolls. 50 cts.

```
        84
       120
      1680
       84
    2)10080
   40)504.0
    4)126
     :: 31=2
         4
       126
        45
       630
      504
    4)5670
      1417.50  Ans.
```

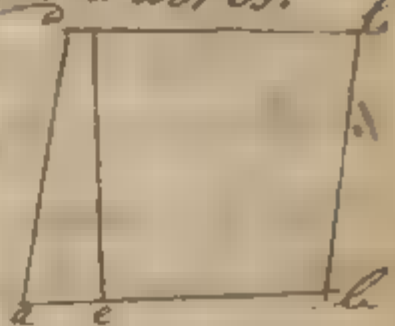
4. How many superficial yards are contained in a trianglar piece of ground. the base of which measures 140 feet. and the perpendicular 70 feet: Ans. 544 yards 4 feet.

```
   140
    70
 2)9800
 9)4900
   544=4  Ans.
```

1. Let A. B. C. D. be a piece of ground in the forme of an oblique parallelogram. the base of which. A. B. measures 44 perches. and the perpendicular. D. E. 40 perches. how many acres does it contain:

```
      44 length
      40 breadth
40)176.0
 4) 44
    11 acres. Ans.
```

2. A piece of ground lying in the forme of an oblique parallelogram. is found to measure 80 perches along its base. and its perpendicual or heighht 24 perches: how many acres does it contain.
Ans. 12 acres.

```
      80
      24
     320
    160
40)192.0
 4) 48
    12  Ans.
```

Example.

1. Let. A. B. C. D. be a piece with four irregular and unequal sides. the diagonal line of which. A. C. measures 80 perches. the perpendicular. B. m. measures 25 perches. and the other perpendicular: D. n. 35 perches: how many acres does it contain:

Operation.
80 the length of the diagonal line
25+35=60 the sum of the two perpendiculars.
2)4800
40)2400 perches.
4)60
15 acres. Ans.

2. In a field of four unequal sides. the diagonal line between the two most distant corners. measures 120 rods. and the perpendiculars measures. the one 48. and the other 24 rods: requires the number of acres it contains:

48
24
72

120
72
240
840
2)8640
40)4320
4)108
27 Ans.

Ans. 27 acres.

||| Examples |||

1. How many acres are contained in a circular piece of ground whose diameter measures 320 perches. or one mile 320×320=102400
7854
409600
512000
819200
716800
40)804249600
4)2010.24.9
502.2.24.9

Ans. 502 acres 2 qr. 24.9 perches.

2. A gentleman has an elliptical yard in front of his house. the longest diameter of which measures 30 perches. and the shortest 20. how much ground is contained herein

Ans. 2 acres 3 qr. 31.2 perches.

7854
600
40)471.2400
4)11.31.24
2.3.31.24 Ans.

3. How many square yards are contained in a circular piece of ground. the diameter of which measures 160 feet:

Ans. 2234+ yards.

160
160
9600
160
25600
7854
102400
128000
204800
179200
9)20106.2400
2234+ Ans.

Guaging. Sam

||| Section 12 |||

1. How many gallons of wine will a cask contain: whose bung diameter is 31 inches. head diameter 25 inches. and whose length is 3 feet. or 36 inches:

31 bung diam.
25 head diam. $\frac{2}{3}$ of 6 = 4
6 difference.

```
      25
       4
      29
      29
     261
     58
     841  square of the mean diam
      36  the length
    5046
   2523
   30276  cubic inches.
```

Then 30276 ÷ 294 = 102 $\frac{288}{294}$ gals. Or. 102 gals. 3 qt. 1 $\frac{22}{38}$ pt.

2. The diameter of a barrel at the bung measures 24 inches. and at the head 18 inches. and its length is 24 inches; what is its content in wine measure: Ans. 39 $\frac{25}{49}$ gals.

```
 24
 18
  6
          18
 2/3 of 6 = 4
          22
          22
          44
         44
         484
          24
        1936
        968
294)11616(39 25/49 gals.
     882
     2796
     2646
      150 = 25
   6) 294   49
```

Mechanical Powers

Section. 13

1. If a man weighing 150 lb. rest on the end of a lever 12 feet long: what weight will he balance on the other end. supposing the prop 1½ foot from the weight.

12 = the length of the lever
1.5 = distance of the weight from the prop
10.5 = the distance from the prop to the man

Then as 1.5 : 10.5 :: 150 : 105. Ans.

2. The pea of a pair of steel yards weighing 5 lb. is removed 20 inches back from the fulcrum: what weight will it balance suspended at 1 inch distance on the opposite side: Ans. 100 lb.

in in lb
1 : 20 : : 5   1 : [illegible] : : 20
5   5
100 Ans.   100

1. It is required to make a windlass be equal to 12 lb. suspended to the axle: now allowing the axle to be 11 inches diameter. what must be the diameter of the wheel:

as 1 lb : 11 in : : 12 lb : 118 in = 11 feet the diam. of the wheel. Ans.

2. Suppose the diameter of an axle to be 6 inches. and that of the wheel 5 feet: what power at the wheel will balance 10 lb. at the axle: Ans. 1 lb.

ft lb in
5 : 10 : : 6
12   6
60) 60
1 lb Answer

Examples.

There is a screw whose threads are [illegible] inch asunder: the lever by which it is turned is 36 inches long. and the weight to be raised a ton. or 2240 lb: what power or force must be applied to the end of the lever sufficient to turn the screw that is to raise this weight:

Thus. the lever 36×2 = 72. and 72×3.14150 = 218.194+ the circumference.

Then. as 218.194 circum. in. : 1 : : 2240 lb. : 10.266 lb. the power Ans.

James Promiscuous

Promiscuous Questions

Examples.

1. What is the sum of 2578. added to itself: Ans. 5156.

```
 2578
 2578
 5156 Ans.
```

2. What is the difference between 14676. and the fourth of itself: Ans. 11007.

```
4)14676     14676
   3669      3669
            11007 Ans.
```

3. There is the sum of 1468 dollars in three bags: the first contains 461. the second 581. how many are in the third bag: Ans. 426.

```
 461      1468
 581      1042
1042       426 Ans.
```

4. What is the sum of the third and half third of 1 dollar: Ans. 50 cts.

```
3)100
2)33 1/3
  16 2/3
  50
```

5. What number is that which being multiplied by 45. the product will be 1080: Ans. 24.

```
45)1080(24 Ans.
    90
    180
    180
```

6. Required the quotient of the square of 476. divided by the half of its root: Ans. 952.

```
      476
      476
     2856
    3332
    1904        2
   226576(476
   16
87) 665        238)226576(952 ans
    609            2142
946) 5676           1237
     5676           1190
                     476
                     476
```

7. A general drawing up his army into a solid square, found he had 231 over and above. but increasing each side with one soldier, he wanted 44 to complete the square: how many men did his army consist of: Ans. 19000.

```
     231
      44
     275
  2)275
     137
     137
     959
    411
   137
   18769
     231
   19000 Ans
```

8. What number added to the cube of 21. will make the sum equal to 113 times 441. Ans. 7350.

21
21
21
42
441
21
441
882
9261

147
113
441
147
147
16611
9261
7350 Ans.

9. A person possessed of 3/8 of a ship. sold 2/3 of his share for 1260 dollars: what was the value of the whole ship at the same rate: Ans. 5040 dollars.

$\frac{2}{3} \times \frac{3}{8} = \frac{6}{24} = \frac{1}{4}$

$\frac{1}{4}$: 1260 :: 1 = 5040
1)5040
5040 Ans.

10. A guardian paid his ward 3500 dollars for 2500 dollars. which he had in his hands for 8 years: what rate of interest did he allow him: Ans. 5 per cent.

3500
2500
2500 : 1000 :: 100
100
1)00000(8)40
10000 5 Ans.
0

11. A young man received 210 dolls. which was 1/3 of his elder brother's portion: now three times the elder brother's portion was half of the father's estate. how much was the estate worth: Ans. 1890.

210
3
2)630
315
3
945
2
1890 Ans.

12. A broker bought for his principal in the year 1720. the sum of 400 dollars capital stock. in the south sea. at 650 per cent. and sold it again when it was worth but 130 dollars per cent: how much was lost in the whole: Ans. 2080 dollars

100 : 650 :: 400
400
260000
52000
208000 Ans.

100 : 130 :: 400
400
520.00

13. A gentleman went to sea at 17 years of age: 8 years after he had a son born. who lived 46 years. and died before his father: after whom the father lived twice 20 years. and then died also: I demand the age of the father when he died: Ans. 111 years

8
46
20
20
111 Ans.

14. A. B. and C. entered into partnership in trade. A put in a sum unknown. B put in 20 pieces of cloth. and C put in 500 dollars: at the end of one year they had gained 1000 dolls. whereof A received 350 dollars for his share. and B 400 dolls. required C's share. how much A put in. and the value of B's cloth: Ans. C's share 250 dolls.—A put in 700 dolls.—B's cloth was worth 800 dolls.

1000
750
250

350
400
750

250 : 500 : : 350
500
250)175000(700 A
1750
00

250 : 500 : : 400
400
250)200000(800 B
2000
00

15.. A captain and 160 sailors took a prize worth 2720 dolls. of which the captain gets 1/5 for his share. and the rest is equally divided among the sailors: what was each one's part: Ans. the captain gets 544 dolls. and each sailor 13 dollars. 60 cts.

5)2720
544 Captain
160)2176(13.60 Each sailors
160
576
480
960
960

16. A lady tells her husband. upon their marriage. that her fortune. the interest of which for one year. at 6 per cent. was 972 dollars. was but the 2/5 of the interest of her father's estate for three years. at the same rate per cent: what was the lady's fortune. and what was the value of her father's estate: Ans. Her fortune was 16200 dollars. and her father's estate was 150000 dollars.

6 : 100 : : 972
100
6)97200
16200 the Ladees fortune.
5
3)81000
3)27000 Interest for 3 years.
6 : 100 : : 9000
100
6)900000
150000 the Fathers fortune

17. A stone measures 4 feet 6 inches long. 2 feet 9 inches. broad. and 3 feet 4 inches deep: how many cubic feet does it contain: Ans. 41 feet 3 inches.

ft in
4 . . 6
2 9
8
3 . . 4 . 6
1
12 . . 4 . . 6
3 4
36
4 . . 1 . . 6 . . 0
1 1 6
41 . . 3 . . 0 Ans.

18. Suppose $\frac{1}{9}$ of a mast or pole stands in the ground. 12 feet in the water. and $\frac{5}{6}$ of its length above the water: what is its whole length? Ans. 216 feet.

$\frac{1}{9}$ $\frac{5}{6}$ ... $\frac{2}{18}$ + $\frac{15}{18}$ = $\frac{17}{18}$

from 1
Take $\frac{17}{18}$
$\frac{1}{18}$

1 : 12 :: 18
12
216. Ans.

19. A gentleman being asked his age. answered. my grand father is 112 years old. and my father is $\frac{4}{7}$ of his age. whilst mine is but $\frac{1}{3}$ of my father's: what was his age? Ans. $21\frac{1}{3}$ years.

112
4
7) 448
64
3) 64
$21\frac{1}{3}$ years Ans.

20. A person who was possessed of $\frac{3}{5}$ share of a copper mine. sold $\frac{3}{4}$ of his interest therein for 1710 dollars; what was the value of the property at the same rate? Ans. 3800 dolls.

$\frac{3}{5}$ $\frac{3}{4}$ = $\frac{9}{20}$ $\frac{9}{20}$: $\frac{1710}{1}$ :: $\frac{1}{1}$ = 34200
9) 34200 (3800 Ans.
27
72

21. There are two numbers. the one 63. the other half as much: required the product of their squares. and the difference of their product and sum:

Ans. { Product of the squares 3938240.25.
{ Difference 1890.

2) 63
31.5
94.5

31.5
63
945
1890
1984.5
94.5
1890.0 Difference

63
63
189
378
3969

2) 63
31.5
31.5
1575
315
945
992.25
3969
893025
595350
893025
297675
3938240.25 product

22. Two men set out at the same time from the same place but go contrary ways and each of them travel 34 miles a day; required the time in which they will have travelled 2000 miles? Ans. 29 days 9 hours 52 $\frac{64}{68}$ minutes.

34
34
68 : 1 :: 2000
68)2000(29 Days.
136
640
612
28
24
112
56
68)672(9 Hours.
612
60
60
68)3600(52 $\frac{64}{68}$ minutes.
340
200
136
64
68

23. If a cannon may be discharged twice with 6 lb. of powder; how many times will 7cwt. 3qr. 17lb. discharge the same piece: Ans. 295 times.

lb. cwt qr lb
6 : 2 :: 7 .. 3 .. 17
4
31
28
255
63
885
2
6)1770
295 Ans.

~~24. What number is that to which if you add $\frac{2}{3}$ the quotient will be 218. Ans. 15~~

24. What number is that to which if you add $\frac{2}{3}$ of itself the sum will be 20? Ans. 12.

6
2
3)12
4
16
20
10
9
90
30
5)60
12 Ans.

9
2
3)18
6
15
20
5
6
30

25. What number is that which being divided by $\frac{3}{4}$ the quotient will be 21. Ans. 15 $\frac{3}{4}$.

21 × 3 = 63
1 × 4 =
4)63
15 $\frac{3}{4}$ Ans

26. What number is that which being multiplied by 15 the product will be $\frac{3}{4}$? Ans. $\frac{1}{20}$.

$\frac{15}{1} \times \frac{3}{4} = \frac{3)3}{60} = \frac{1}{20}$ Ans.

27. What number is that from which if you take $\frac{3}{5}$ the remainder will be $\frac{1}{8}$? Ans. $\frac{29}{40}$.

$\frac{3}{5}$ $\frac{1}{8}$
5)40
8
8 × 3 = 24
5 × 1 = 5
29
40
Ans.

28. What number is that whose half is equal to its square? Ans. 5.

7   7
35 : 7 :: 49
7
49)245(.5 Ans.
245

29. A gentleman wishing to distribute some money among a number of children found he wanted 8 cents to give them 3 cents a piece. he therefore gave each 2 cents and had three cents left: how many children were there? Ans. 11.

30. In what time will 500 dollars amount to 1000. at 6 per cent. per annum?
Ans. 16 years 8 months.

500
6
30.00 : 1 years :: 500
30)500(16 years.
...
30)240(8 months.
240

31. When ½ of the members of congress were assembled + 15 there were ⅓ + 10 absent: how many members were in all?
Ans. 150.

5)750
150 Ans.

32. If the earth be 360 degrees round. each 69½ miles: how long would it take a man to travel once around. at 20 miles a day. admitting there were no obstacles in the way. and reckoning 365¼ days in the year?
Ans. 3 years 155½ days.

360
69½
365.25)1251.00(3 years.
1095.75
155.25 Days.

33. What is the mean time for paying 100 dollars at 3¼ months. 150 dolls. at 11½ months. and 204 dolls. at 5¾ months.? Ans. 4 months. 23 $\frac{134}{227}$ days.

100 × 3.25 = 325
150 × 11.5 = 675
204 × 5.75 = 1173
454

454) 2173 (4 months.
1816
357
30
10710 (23 $\frac{134}{227}$ Days
908
1630
1362
2) 268 = 134
454 = 227

34. If A can do a piece of work alone in 7 days. and B do the same in 12. how long will it require them both together? Ans. 4 $\frac{8}{19}$ Days.

D W D
7 : 1 :: 1 : $\frac{1}{7}$
12 : 1 :: 1 : $\frac{1}{12}$ $\frac{1}{7}$

12) 84
7 × 1 = 7
7 12 × 1 = 12
19
84

W D W
$\frac{19}{84}$: $\frac{1}{1}$ :: $\frac{1}{1}$: $\frac{84}{19}$) 84 (4 $\frac{8}{19}$ Ans.
76
$\frac{8}{19}$

$\frac{12}{7}$
7 : 12 :: 19
19) 84 (4 $\frac{8}{19}$ Ans.
76
8
19

35. A minor of 14 years of age had an annuity left him of 400 dolls: this sum his guardian agreed to receive yearly, and allow him compound interest at 5 per cent. thereon. Till he should arrive at 21 years of age: how much must he then receive? Ans. 3256 dollars 80 + cts.

400 / 5 / 20.00 / 400	1	
420.00 / 5 / 21.00.00 / 420	2	400
441.00 / 5 / 22.05.00 / 441	3	420
463.05.00 / 5 / 23.15.25 / 46305	4	440
486.20.25 / 5 / 24.31.01.25 / 48620.25	5	463.05
510.51.26.25 / 5 / 2552.56.31.25 / 51051.26.25	6	486.20.25
		510.51.26
536.03.82.56.25	7	536.03.82
		3256.80.33 Ans.

36. Sold goods to the amount of 700 dolls. for 4 months; what was the present worth at 5 per cent simple interest? Ans. 688 dolls 52 cts.

Months
4
5
12)20
1.6666
100
101.6666 : 100 :: 700
700
101.6666)70000.000000(688.52+
609996
900040
813332
866712
813332
533792
508333
254590
203333

Ans.

37. Three persons A. B. and C. purchased a lot in partnership, for which A advanced $\frac{3}{8}$, B $\frac{3}{7}$, and C 140 dollars; what did A and B pay, and what part of the lot belonged to C?

Ans. { A paid 267 dolls. 27+ cts.
B paid 305 — 45 $\frac{5}{11}$ —
and C had $\frac{11}{56}$ parts.

$\frac{3}{8}$ $\frac{3}{7}$
7
8)56
7×3 = 21
8×3 = 24
45
56
Ans. $\frac{11}{56}$ C

11 : 140 :: 24
24
560
280
11)3360(305.45 $\frac{5}{11}$ B
33
60
55
50
44
60
55
5
11

Ans.

11 : 140 :: 21
21
140
280
11)2940(267.27+ A
22
74
66
80
77
30
22
80
77
3+

Ans.

38. A gentleman finding several beggars at his door: gave to each four cents and had sixteen left but if he had given to each six cents he would have wanted twelve; how many beggars were there? Ans. 14.

10 × 4 = 40, 40 + 16 = 56, 56 − 48 = 8
10 × 6 = 60, 60 − 12 = 48
12 × 4 = 48, 48 + 16 = 64, 64 − 60 = 4
12 × 6 = 72, 72 − 12 = 60

10 — 8 = 96
12 — 4 = 40
4)56
14. Ans.

39. B. and C. can build a wall in 18 days, but with the assistance of A. they can do it in 11 days: in what time can A do it alone?

Suppose the work to consist of 198 parts.

Then 198 ÷ 18 = 11 parts performed by B and C. in one day.

Again. 198 ÷ 11 = 18. performed by A. B. and C. in one day.

But 18 − 11 = 7 parts performed by A alone.

and As. 7 : 1 :: 198 : 28 d 3 h 25 $\frac{5}{7}$ m Ans.

7 : 1 : : 198
7)198(28 D
14
58
56
2
12
7)24(3 H
21
3
60
7)180(25 5/7
14
40
35
5
7

D H M
28 . 3 . 25 5/7 Ans.

40. Twenty members of congress. 30 merchants. 24 lawyers. and 24 citizens. spent at a dinner 192 dollars; which sum was divided among them in such a manner. that 4 members of congress paid as much as 5 merchants. 10 merchants as much as 16 lawyers. and 8 lawyers. as much as 12 citizens; the question is to know the sum of money paid by all the members of congress; also, by the merchants, lawyers, and citizens?

Ans. The 20 members of congress paid 60 dollars. the 30 merchants paid 72. the 24 lawyers paid 36. and the 24 citizens paid 24.

M congress 20 each Spent 1/4 = 5
Merchants 30 ——— 1/5 = 6
Lawyers 24 ——— 1/8 = 3
Citizens 24 ——— 1/12 = 2
16

If 16 : 192 : : 5
5
16)960(60 the Congress
96
0

If 16 : 192 : : 6
6
16)1152(72 Merchants
112
32
32

If 16 : 192 : : 3
3
16)576(36 Lawyers
48
96
96

If 16 : 192 : : 2
2
16)384(24 citizens
32
64
64

41. What difference is there between a piece of ground 28 perches long. by 20 broad. and two others each of half those dimensions?

Ans. 1 acre 3 qrs.

28
20
2)560
160)280(1 acre.
160
40)120(3 qrs.
120

42 Required the dimensions of a parallelogram containing 200 acres. which is 40 perches longer than wide? Ans. 200 perches by 160.

40)
80
160)3200(20
320
0

20 : 3200 : : 200
200
2(0)640000
160)32000(200.
320
00

43. How many acres are contained in a square field the diagonal of which is 20 perches more than either of its sides?
Ans. 14 acres 2 qrs. 11 per

30
30
900
900
1800 (42.4
16 / 20
8.2) 200 / 12.4
164
84.4) 3600
3396

12.4 : 30 :: 20
20
12.4) 600.0 (48.3
496
1040
992
480
372
108

48.3
48.3
1449
3864
1932
40) 2332.89
4) 58 : 1
14 .. 2 .. 12 Ans

44. The paving of a triangular yard at 18d. per foot came to 100l; the longest of the three sides was 88 feet; what then was the sum of the other two equal sides? Ans. 106.85 feet.

d. ft. £
18 : 1 :: 100
20
2000
12
18) 24000 (1333.333

1333.3330 (36.514
9 / 2
6.6) 433 / 73.028
396
72.5) 3733
3625
730.1) 10730
7301
7301.4) 342900
292056
50844

36514 : 73028 :: 88
36514
292112
73028
365140
438168
219084
88.000000) 2666.5144392 (30.301
264000000
2654439200
264000000
1443920000
88000000
56392000

44
44
176
176
1936

30301
30301
30301
909030
909030
918.150601
1936
2854.150601 (53.424
25 / 2
10.3) 354 / 106.848 Ans.
309
106.4) 4515
4256
1068.2) 25906
21362
4544.01
4273.76
37025

115. Required the length of a line by wick acircle that shall contain Just half an acre may be laid of? Ans. 27¾ yards.

2)160
80(8.94
64
16.9)1600
1521
178.4) 7900
7176

1.12837
8.94
451348
1015533
902696
10.0876278
5½
50438139 0
5043813 9
2)55481952 9
27.7404764 Ans.

116. A ceiling contains 114 yards 6 feet of plastering and the room is 28 feet broad: what is its length? Ans. 36 6/7 feet

114 : 6
9
28)1032(36 6/7 Ans.
84
192
168
4)24 = 6
28 = 7

117. A common joist is 7 inches deep and 2½ thick. but I want another just as big again that shall be three inches thick: what must be its other dimensions? Ans. 11⅔ inches.

7
2½
14
3.5
17.5
2
3)35.0
11⅔ Ans.

118. If 20 feet of iron railing weigh half a ton. when the bars are an inch and a quarter square. what will 50 feet come to at 3½d. per pound. the bars being but ⅞ of an inch square? Ans. 20l. 0s. 2d.

cwt
20
¼
20
5
25
1¼
25
6.25 Cwt
3.125 : 10 :: 38.28125
10 Cwt
31.25000) 382.81250(12.25
3125000
703125
6250000
7812500
6250000
15625000
15625000

50
2
8)350
43.75
7
8)30625
38.28125

lb d cwt
1 : 3½ :: 12.25
4
49.00
28
392
98
1372
3½
4116
686
12)4802
2(0)40(0 - 2
20 - 0 - 2 Ans.

119. A may-pole whose top being broke off by a blast of wine struck the ground at 15 feet distance from the foot of the pole; what was its whole height. supposing the length of the broken piece to be 39 feet? Ans. 75 feet.

15
15
75
15
225

39
39
351
117
1521
225
1296(36 | 39
9 | 75 Ans
6.6) 396
396

500
250
250
550

24
9
216(6
216 4
3)24
8
64
4
5)60
12
8
96
7
103 Ans.

50. Required a number: from which, if 7 be subtracted, and the remainder be divided by 8, and the quotient be multiplied by 5, and 4 added to the product, the square root of the sum extracted, and three-fourths of that root cubed, the cube divided by 9, the last quotient may be 24?
Ans. 103.

103
7
8)96
12
5
60
4
64(8
64 3
4) 24
6
36
6
9)216
24 proof

51. A vintner has a cask of wine containing 500 galls. of which he draws 50 galls. and fills it up with water. [illegible] repeats the same thing five times; I demand what quantity of wine and also of water is then in the cask?
Ans. 295 galls. 1qt. of wine and 204 galls. 3 qts. of water nearly.

Wine
500
50 −
450
45 −
405
40..2 −
364..2

Water
50
5 −
45
50 +
95
9..2
85..2
50
135..2

500 : 50 :: 450
50
500)22500
45
50
5

500 : 50 :: 405
50
500)20250(40..2
2000
250
4
1000(2
1000

500:50::364..2
4 | 4
2000 | 1458
50
2000)72900(36 G
6000
12900
12000
900
4
2000)3600(1 qr
2000
1600
2
2000)3200(1 P
2000
1200
4
2000)4800(2 gils
4000
4)8|00 = 4
20|00 = 5

50
36..1..1..2 2/5
13..2..0..1 3/5

53. A owed B 1864 dollars for which he gave his note on interest bearing date April 1st. 1817. On the back of the note are the following endorsements viz.

Oct. 15th. 1817. Received in cash 225 dolls. 50 cts.
Jan. 10th. 1818. Received in cash 150 —
Same date one bag of coffee: weight 1 cwt. 22 lb. at 29 cts per pound
May 16th. Received 3 ton of iron at 195 dolls. per ton.
What is the sum due from A to B on the 1st of August. 1818?

D. 6

1864.00	principal
60.58	interest
1924.58	amount
225.50	Recipt
1699.08	second principal
24.07	Sec interst
1723.15	amount
188.86	Recipt
1534.29	Third pri
32.22	inter
1566.51	amount
555.00	Receipt
1011.51	Fourth pri
12.47.5	Interes
1023.98.5	Ans.

1864
195
3320
16776
1864
6(0)36348(0
60.58

1699.08
85
849540
1359264
6(0)144421.8(0
24.07.03

1534.2903
126
92057418
184114836
6(0)193320577(8
32.22.0096

195
3
555

1.0 .. 22
4
4
28
134
29 cts
1206
268
38.86
150
188.86

101151
74
404604
708057
6(0)748517(4
12.47.5

54. How many cords are there in a pile of wood 36 feet long 6½ feet wide and 8¾ feet high?

8.75
6.5
4375
5250
56875
36
341250
170625
128.000)2047.500(15. Ans.
128000
~~128000~~
767.500
640000
127500
128000

55. If a [illegible] spends 356 dolls 34 cents per year. how much will it be per day?

Days D C C
365)356.34(97 Ans.
3285
2784
2555
229
365

56. A bankrupt. whose whole property is worth 2564 dolls. 95½ cents. can pay his creditors but 18¾ cents on a dollar; how much does he owe?

18.75 : 1 :: 2564.95.50

1875)2564.95.50(13679 + Ans.
1875
6899
5625
12745
11250
14955
13125
18300
16875
1425

57. If 8 men spend 20 dollars 50 cents in 3 days. how long will 64 men be in spending 100 dollars at the same rate?

2050 : 30 :: { 64, 10000 }
64
8200
12300
131200

80000
30
131200)2400000(18 12/41 Ans.
131200
1088000
1049600
32)38400 = 12/41
131200

58. A bridge built over a stream in 6 months by 34 men, being washed away by a flood. how long time will it take 86 men to build another in its place of twice as much work?

months days
4 22+ Ans.

Work 34 / 86 } : 6 :: { men 86 1, 2 Work }
34
68
6
86)408(4 mo
344
64
30
86)1920(22+
172
200
172
28

59. Three gardeners. A. B and C. having bought a piece of ground. find the profits of it to amount to 240 dolls. a year; now the sum of money which they gave. was in such proportion. that as often as A paid 5 dolls. B paid 7, and as often as B paid 4 dolls. C paid 6: how much must each man receive for his share of the profits per annum?

4)28 / 7
5×4 = 20 A
7×4 = 28 B
6×7 = 42 C
90 : 20 :: 240
20
9(0)480(0
A 53.33 3/9

90 : 28 :: 240
240
1120
56
9(0)672(0
B 74.66 6/9

90 : 42 :: 240
240
1680
84
9(0)1008(0
112.00 C
74.66 6/9
53.33 3/9
240.00 Proof

60. If a county tax of 7 cents and 3 mills is assessed on property. how much must that [illegible] pay whose property is valued at 8564 dollars 20 cents?

D Cm D C
100 : 73 : : 8564.20
73
2569260
5994940
100)625186.60 Ans

61. Suppose a cistern having a pipe which conveys 4 gallons 2 quarts into it in an hour. and has another that lets out 2 gallons 2 quarts and 1 pint in an hour: in what time will it be filled. allowing it to contain 84½ gallons?

G qt pt
4 : 2 : : 0
2 : 2 : : 1
1 : 3 : 1 : 1 : : 84½
4 4
7 338
2 2
15 15)676(45.4 Ans.
60
76
75
60(4 mi
60

62. What is the length of a lane. which being 36 feet wide that will contain just one acre of ground?

160
16½
960
160
8
36)2640(73.⅓ Ans.
252
120
108
12)12(1/3
36

73⅓
36
438
219
12
2640 proof

63. If 50 men consume 12 bushels of grain in 30 days. how much will 40 [illegible] consume in 90 days?

[illegible] 50
Days 30
1500

: 12 : : 40 men
90 Days
3600
12
1500)43200(28 4/5 ans
3000
13200
12000
3)12|00(4/5
15|00

64. A gentleman had 18 dollars 90 cents to pay among his laborers; to every boy he gave 6 cents. to every [illegible] 8 cents. and to every man 16 cents; now there were three women for every boy and two men for every woman; required the [illegible]mber of each?

3×6 = 18 B
9×8 = 72 W
18×16 = 288 M
378 : 3 : : 18.90
3
378)5670(15 Boys
378 3
1890 45 Women
1890 2
90 Men

Proof
B 15×6 = 90
W 45×8 = 360
M 90×16 = 1440
1890 proof

65. Two men depart from the same place and travel the same way: the one travels at the rate of 3 miles an hour. for 8 hours every day. the other goes at the rate of 4½ miles. for 7 hours each day; how far are they aprt at the end of 13 days?

H 8 3 24 13 72 24 312

H 7 4½ 28 3.5 31.5 13 945 315 409.5 312

Ans. 97.5 m

66. A began to trade on the 1st of january. with a capital of 962 dollars: on the 15th of April following. he took in B as a partner. with 1635 dollars: on the 1st of july. A put in 320 dollars more. and 1 month after B drew out ¼ of his capital: on the las day of December: on settling their acounts. they found a gain of 486 dolls 64 cents: what was each partner's share?

962×12 = 11544
320×6 = 1920
13464
11853.75
G 25317.75

1635×8½ = 13897.5
408.75×5 = 2043.75 B
11853.75

S G S
25317.75 : 486.64 : : 1346400
486.64
5385600
807840
807840
107712
53856
25317.75)6552120.9600 (258.79 A
5063550
14885709
12658875
22268346
20254200
20141460
17722425
25190.5000
22785975

S G S
25317.75 : 486.64 : : 1185375
486.64
4741500
7112250
7112250
9483000
4741500
25317.75)5768508.9000 (227.84 B
5063550
7049589
5063550
19860390
17722425
21379650
20254200
11254500
10127100

B 227.84
A 258.79
486.63

Proof

67. Suppose the Ohio river to be 250 feet wide. 6 feet deep. and run at the rate of 2 miles an hour: in what time will it fill a cistern of two miles in length. breadth and delpth. the mile being 5280 feet?

70. An old soldier lately received a sum of money [illegible] pension from government: of this sum he paid 94 dollars in the payment of debts which he then owed. half of what remained he lent to a friend. and a fifth he gave for a suit of clothes: he then found that nine-tenths of his money was gone: what sum did he at first receive?

400
94
2)306
5)153
61.2
94
308.2

400
9
3600
3082
518

600
94
2)506
5)253
101.2
94
448.2

600
9
5400
448.2
91.8
51.8
40 0

1st. Error 518
2nd Suppos 600
310800

91.8 Second Error
400 first Suppos
367200
310800
400)56400
141 Ans

141
94
2)47
5)23.5
9.4
94
126.9

141
9
10)1269
126.9 proof

71. What number is that of which the difference be'tween its third and fourth parts is 14?

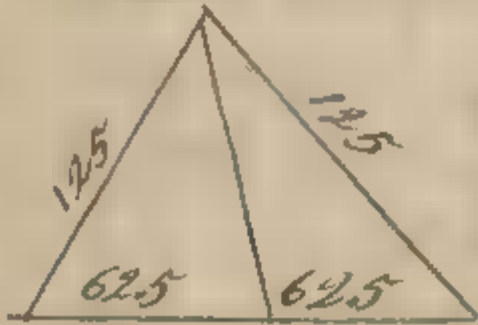
3)150
50
37.5
12.5 : 150 :: 84
150
4200
84
12.5)126000(1008 Ans
125
1000
1000 4)3)1008
336
252
proof 84

72. In turning a chaise within a circle of a [illegible] diameter. it was discovered that [illegible] the outer wheel turned thrice. while the inner turned twice: now supposing the axle tree 4 ft long. and the wheels of [illegible] equal size. the length of the circumference described by each wheel is required?

3.1416
24
125664
62832
3)75.3984 Circu of L
25.1328

3.1416
16
188496
31416
2)50.2656 Circum of S
25.1328

4
4
16
8
24

73. The sum of the sides of an equilateral triangle is 125 feet; required the area thereof?

```
  125              62.5
  125              62.5
  625              3125
 250              1250
125              3750
15625            3906.25
 3906.25
11719.75   (2) 107.32 root of the difference of the squares
1                   53.66
207) 1719
     1449               53.66
2143) 7075                125
      6429             26830
21462) 59600           10732
       42924           5366
       16676           6707.50  Ans.
```

125, 125, 62.5, 62.5

James McCornick

His Book. 1822

James McCormick His Book

£ S D

7) 25 .. 16 .. 9 $\frac{25}{63}$

3 .. 13 .. 9 $\frac{1103}{7\ 441}$ Ans

25 .. 16 .. 9 $\frac{25}{63}$ Proof

$\frac{1103}{441} \times \frac{1}{7}$

) 2821 (6 $\frac{25}{63}$
2646
7) $\frac{175}{441} = \frac{25}{63}$

Rule for Dividing

Devide the whole numbers as usual and what is over multiply the Denominator with it and add in the numerator. for anew ~~denominator~~ numerator. and multiply the Denomanator with the Devisor for A new Denomanator

Divide 20 lb of beef between A B and C give A $\frac{1}{3}$ B $\frac{1}{4}$ and C $\frac{1}{5}$

3
4
12
5
60

1	
3	60 = 20
4	60 = 15
5	60 = 12

47 : 20 :: 20
20
47) 400 (8 $\frac{24}{47}$ A
376
24
47

47 : 20 :: 15
20
47) 300 (6 $\frac{18}{47}$ B
282
18
47

47 : 20 :: 12
20
47) 240 (5 $\frac{5}{47}$ C
235
5
47

A 8 $\frac{24}{47}$
B 6 $\frac{18}{47}$
C 5 $\frac{5}{47}$
20 lb $\frac{47}{47}$ (1 Proof

James McE

$\frac{1}{3} \frac{1}{4} \frac{1}{5}$
$3 \times 4 \times 5$ = 60.

1	60
3	20
4	15
5	12

47
60 : 20 ~~:: 1~~ $\frac{1}{3}$

141
20
141) 1200 (8 $\frac{24}{47}$ A Ans
1128
3) $\frac{72}{141} = \frac{24}{47}$

Print of Frame

James

Georges Township. January 20th 1825

26	~~Noble McCormick dr to one days work braking flax at 33⅓ cents per day~~	~~1~~	33⅓
	Noble McCormick dr to one and A half Days work Coping sawlogs	1½	
	Noble McCormick dr to Three days and A halfs work tramping out wheat and cleaning up and going to mill	3½	
	Noble McCormick Dr to one days work braking flax	1	
	Noble McCormick dr to four Days work halling sawlogs	4	
	Noble McCormick Dr to one days work halling rails	1	
	Noble McCormick dr to three days work Halling off ston and one days work making A waggen bee and halling ston	4	
	Noble McCormick dr to two days work halling rails and eaf ful poles and A half adays work going to mill	2½	
		17½	Ams

To

James McCormick Dr

Apple

10 Gallons one and ahalf or two and ahalf for 20 fifty sent bucket full and ahalf Two pints and [illegible] a half

Received of Mr James McCormi[ck] one dollar & forty two Cents the ballance in full of his account

1.42 2 March 1826 Joshua Har[illegible]

What [illegible] true to 6 Decimal places will produce the same result as if multiplied by $\frac{222}{1000}$

.222)1.000
888
1120
1110
1000
888
112

.004504 the true Divisor Answer

.004504)1.0000
9008
9920
9008
9120
9008
112

(.222

Proof

1.000
.222
222.000

To find the Solidity of a cannon ball whose circumfer. is 12 Inches

Circumf is as 3.14 : to 1 Diameter

As 3.14 : 1 :: 12

(6)

3.14)12.00(3.82 Diameter
942
2580
2512
680
628

12 Inches
3.82
45.84
.636
27504
13752
27504
29.15424

.636

Answer - Cubic Inches of the ball

		3		
	2	7	6	
1	9	5	1	9
	4	3	8	
		7		

2	7	6
9	5	1
4	3	8

Dis Pepsay Medicon

Colombo ℥1 } Mix them } take a large tea spoon full every morning Noon & evening a half hour after eating in a little water
Magnesia alba ℥1 }

9008
112

1.000
.222
222.000

To find the solidity of a cannon ball whose circumf is 12 Inches

Circumf is as 3.14 : to 1 Diameter

As 3.14 : 1 :: 12 (6)

3.14) 12.00 (3.82 Diameter
9 42
2 580
2 512
680
628

.636

12 Inches
3.82
45.84
.636
27504
13752
27504
29.25424

Answ — Cubic Inches of the 6

	2	7	6	
		3		
	2	7	6	
1	9	5	1	9
	4	3	8	
		7		

2	7	6
9	5	1
4	3	8

Hors Distring forthe Bots first Bleed in the moth ane then hole up there heae about fif teen minnets ane thengive them as much in digo as will lie one aleavenpenny bit in three gills of whiskey

Salt ane ingen meal half each made up with milk for the neck poltice worm

Salts of wormwood put one table spoonful in a quart of strong vinegar half table spoonful to be given every hour until the fever abats

Fayett County James McCormick

JOHN 4 JO J L Lyl

Henry Savage Lether

Letherman Joel

Letherman

1 1 A 1 1

A Gentleman divided his Estate among his several Sons Equally Viz the first he gave 100 $ and 1/8 of the balance The second he gave 200 and 1/8 of the balance the third he gave 300 and 1/8 of the balance And so on till he had his Estate divided how many Sons had he and what was each mans share And What was his estate Answ 7 Sons each 700 $ Estate = 4900

Suppose 1st 1700

1700
100
1/8) 1600
200
100
300 first sons share

1700
300
1400
200
1/8) 1200
150
200
350 second sons
300
50 = 1st Error

Suppose 2nd 3300 $

3300
100
1/8) 3200
400
100
500 first sons share

3300
500
2800
200
1/8) 2600
325
200
525 second sons sh
500
25 = 2nd Error

1700 × 50 = 165000
3300 × 25 = 42500

1700
17500
25
42500

122500

difference of Err. 25) 122500 (
100
225
225

Estate
4900
100
1/8) 4800
600
100
700

Each 700) 4900 (
4900 (7 Sons each 700 $ whole Estate 4900

Answer

Dollars Dollars 50 Philadelphia July 9 [illegible]

I promise to pay to John Gould or order the sum of Fifty Dollars on demand with interest till paid, without defalcation Value received Jacob Smith

[illegible]ars 50 Philadelphia July 9 the 1821

[P]romise to pay to John Gould or order the sum of Fifty Dollars [on] demand with interest till paid without defalcation Value received

Jacob Smith.

Dollars 50 Philadelphia July 9 the 1821

I promise to pay to John Gold or order the sum of Fifty Dollars on demand with interest till paid without defalcation Value received

John Smith

Dollars 50 Philadelphia July 9 the 1821

I promise to pay to John Gold or order the sum of Fifty Dollars on demand with interest till paid without defalcation value received

James McCormick

Samuel McCormick

Samuel McCormick

The Single Rule Of Three

15

1200 men stationed in a garrison have provision for 9 months at the rate of 14 onces per day how long at the same ~~time~~ allowance will the same provisions last if they are reinforced by 400 men and also what diminution must be made on each ration that the provision may last for the same time

1200 :: 9 : 1600

16.00)108.00(6 3/4

4/ 12/16 = 3/4

400 : 14 : 1600

1600/5600(3 1/2

16

If a piece of land 40 rods in length and 4 in bredth make an acre how wide must it be if it is but 25 rods long

40 : 4 : 25

25)160(6 2/5

5/ 10/25 = 2/5

17

How much in length that is 3 inches broad wil make a square foot

12 : 12 : 3

3/144

48 Ans

18

If a ~~cow~~ pasture field will feed 6 cows 91 D how long will it feed 21 cows

6 : 91 :: 21

21)546(26

42

126

126

19

There is a cistern having 1 pipe which wil empty it in 10 hours how many pipes of the same capacity will empty it in 24 min

10 : 1 : 24

60

600

24)600(25

48

120

120

20

How many yds of carpet that is half a yard wide will cover a floor that is 30 foot long and 18 foot wide

30 : 18 : 15

15)5400(360

45

90

90

120 Ans

Compound Fellowsip

RULE WHAMCO

1 Three merchants enter into partn for 12 months A put into stock at first [illegible] 800 $ and at the end of 8 mon put in 200 $ more B put in at first 2000 $ at the end of 11 was obliged to take out 600 $ C put in at first 1000 $ and at the end of 2 m put in 800 more with this stock they gained 2300 $ what is each mans share

6001 8 = 4800
[illegible] 8 = 6400
11200
[illegible] 11 = 13000
[illegible] 1 = [illegible]
15600
1000 X 12 = 12000
1800 X 11 = 7200
19200

11200
15600
19200
46000 : 2300 :: 11200
2300
33600000
22400
46000) 25760000 (560 $ As
230
276
276
0

46000 : 2300 :: 15600
2300
468
31200
46000) 35880000 (780 Bs
322
368
368

46000 : 2300 :: 19200
2300
576000
38400
46000) 44160000 (960 Ds
414
276
276
0

3 A and B join stock in trade A put in [illegible] on the first January B advances on the first of april a sum which entitled him to an equal share of the profit at the end of the year requir the sum B put in

M
12
3
9 : 600 : 12
12
9) 7200
800 dolrs
Bs

(4) D put in stock 1800 $ E at the end of 4 months to advanc such a sum at the end of the year will entitle him to an equal of the profits at the end of the year required the sum E put in

12
11
: 1800 : 12
12
8) 21600
2700 Ans

5 Two gentleman A and B hired a cariage to go to pi and return for 100 $ with liberty to take in two by the way when at philadel they took in C and after wards 100 miles from petersburg they took in D How allowing it to be 300 miles from philadelps to pittsburg and its that each man pay in porpotn

Aim at improvement in
Aim at improvent in al
Aim at improvement in
Aim at improvement
mischief

Vulgar Fractions By Wm. H. Ch

Case 1

2 Reduce $\frac{144}{216}$ to its lowest terms

$72 \mid \frac{144}{216} = \frac{2}{3}$ Ans

3 Reduce $\frac{75}{125}$ to its lowest terms

$25 \mid \frac{75}{125} = \frac{3}{5}$ Ans

4 Reduce $\frac{4800}{10800}$ to its lowest terms

$12 \mid \frac{4800}{10800} = \frac{4}{9}$ Ans

5 Reduce $\frac{91}{117}$ to its lowest terms

$13 \mid \frac{91}{117} = \frac{7}{9}$ Ans

6 Reduce $\frac{9876}{88884}$ to its lowest terms

$9876 \mid \frac{9876}{88884} = \frac{1}{9}$ Ans

Case 2

2 Reduce $12\frac{1}{17}$ to an improper fraction

$12\frac{1}{17}$

17

$\frac{219}{17}$ Ans

3 Reduce $183\frac{5}{21}$ to an improper fraction

$183\frac{5}{21}$

21

183

366

$\frac{3848}{21}$ Ans

4 Reduce $514\frac{5}{16}$ to an improper fraction

$514\frac{5}{16}$

16

3084

514

$\frac{8229}{16}$ Ans

5 Reduce $68425\frac{3}{4}$

4

$\frac{273703}{4}$ Ans

Case 3

2 Reduce $\frac{3848}{21}$ to its proper fraction

$21 \mid 3848 \ (183\frac{5}{21}$ Ans

21

174

168

68

63

5

3 Reduce $\frac{2465}{7}$ to its proper fraction

$7 \mid 2465$

$352\frac{1}{7}$ Ans

4 Reduce $\frac{961}{17}$ to its proper fraction

$17 \mid 961 \ (56\frac{9}{17}$ Ans

85

111

102

9

5 Reduce $\frac{8229}{16}$ to its proper terms

$16 \mid 8229 \ (514\frac{5}{16}$ Ans

80

22

16

69

64

5

16

Sacramental Inquisition

Geometrical Progression

Double Position

Permutation By Wm H. M

4 What number of variations will the 9 digits admit of

Answer 362880

1
2
3
4
5
6
7
8
9

32

Ans

Carpenters or Sliding Rule

Rule

EXAMPLES

4 What is the

Ans

Promiscuous Questions By

10 A guardian paid his ward 3500 $ for 2500$ which he had in his hands 8 years what rate of interest did he allow him Ans 5 per ct

2500 : 100 :: 1000

2500)100000(8)40 5 per ct

11 A young man received 210 $ which was ⅓ of his elder broth share now three times the elder brothers portion was half the fathers estate how much was the estate worth Ans 1890 $

210
3
630
3
1890 Ans

12 A broker bought for his principal in the year 1720 the sum of 400$ capital stock in the south sea at 650 per cent and sold it again when it was worth but 130 per cent how much was the loss on the whole Ans 2080 $

100 : 130 :: 400

100)52000

100 : 650 :: 400
100)2600
2600
520
2080 Ans

13 A gentleman went to sea at 17 years of age 8 years after he had a son born who lived 46 years and died before his father after whom the father lived 40 and then died also I demand the age of the father when he died Ans 111

17
8
46
40
111 Ans

15 A B and C entered into company A put in a sum unknown B put in 20 pieces of cloth and C put in 500$ at the end of one year they had gained 1000 $ whereof A received 350 $ for his share and B took for his share 400 $ require C's share how much A put in and the value of B's cloth Ans C's share 250 $ A put in 700 $ B cloth 800

350
400
750

1000
750
250

250 : 500 :: 350

250 : 500 :: 400 800

(51) $5 \overline{|50}$ 10

$\frac{1}{10}$ | 500
50
$\frac{1}{10}$ 450
45
$\frac{1}{10}$ 405
40.5
$\frac{1}{10}$ 364.5
36.45
$\frac{1}{10}$ 328.05
32.805
295.245 = 295 = 1 wine galls of

gall
500 of
295 = 1
204 = 3 water

(58) 34 : 1 m 6 | :: 86
34 | 2
172
6
34) 1032 (m 3 = 1 $\frac{10}{17}$ D Ans
102
12
80
960
34
2 | 20 = 10
34 = 17

(59) 4 : 7 : 6
7
4) 42
$10\frac{1}{2}$

5 = A
7 = B
$10\frac{1}{2}$ = C
$22\frac{1}{2}$ Sum

22.5 : 240 : 5 = 53.3+ As
22.5 : 240 : 7 = 74.6+ Bs
22.5 : 240 : $10\frac{1}{2}$ = 112 Cs Ans

(64) Sup 1 boy
1×6 = 6
3×8 = 24
6×16 = 96

126 : 1890 : 24
24
7560
3780
126) 45360 (360
378
756
756
0

126 : 1890 :: 6
6
126) 11340 (90
1134
0

126 : 1890 : 96
96
11340
17010
126) 181440 (1440
126
554
504
504
504

6 | 90
15 boys
8 | 360
45 women 90
16 | 1440 360
90 men 1440
1890 Proof

10 Reduce $\frac{a-\sqrt{b}}{a+\sqrt{b}}$ to a fraction having a rational Denominator

$$\frac{a-\sqrt{b}}{a+\sqrt{b}} = \frac{a-\sqrt{b} \times a-\sqrt{b}}{a+\sqrt{b} \times a-\sqrt{b}}$$

$a-\sqrt{b}$
$a-\sqrt{b}$
$-a\sqrt{b}+b$
$a^2-a\sqrt{b}$

$$\frac{a^2-2a\sqrt{b}+b}{a^2-b} \text{ Ans}$$

$a+\sqrt{b}$
$a-\sqrt{b}$
$-a\sqrt{b}-b$
$a^2+a\sqrt{b}$
$a^2 \quad -b$

Examples for Practice

Find the 4th root of $81a^2$

$81a^2$
$9a$ = the 2nd p
Ans $3\sqrt{a}$ 4th root

2 Find the 6th root of $(a+b)^{-3}$ | $(a+b)^{\frac{3}{6}} = \frac{1}{2}$
$(a+b)^{-\frac{1}{2}}$ Answer

3 Find the nth root of $(x-y)^{\frac{1}{6}}$ | $\frac{1}{6} \div n = \frac{1}{6} \times \frac{1}{n} = \frac{1}{6n}$
nth root of $(x-y)^{\frac{1}{6}} = (x-y)^{\frac{1}{6n}}$ Ans

4 Find the cube root of $-125ax^6$
$-\sqrt[3]{125x^6}\sqrt[3]{a} = -5x^2\sqrt[3]{a}$ Ans

5 Find the square root of $\sqrt[3]{\frac{4a^4}{9x^2y^2}} = \sqrt[3]{\frac{2a^2}{3xy}}$ Ans

6 Find the square root of $\frac{32a^5x^{10}}{243}$ | $\frac{\sqrt[5]{32a^5x^{10}}}{}$
$\sqrt[5]{243} = 3$
$\frac{2a\ x^2}{3}$ Ans

7 Find the square root of $x^2-6bx+9b^2$
$x^2-6bx+9b^2 = x-3b$

$x-3b$
$x-3b$
x^2-3bx
$\quad -3bx+9b^2$
$x^2-6bx+9b^2$ Proof

8 Find the square root of $a^2+ay+\frac{y^2}{4}$
$a^2+ay+\frac{y^2}{4} = a+\frac{y}{2}$ Ans

Radical Quantities by [illegible]

9 Reduce ax^2 to the form of the 6th root
$\sqrt[6]{a^6x^{12}}$ Ans

10 Reduce -3y to the form of the cube root | $\sqrt[3]{-27y^3}$ Ans

11 Reduce a^2 and $a^{\frac{1}{3}}$ to a common index
a^2 $a^{\frac{1}{3}}$ $(a^6)^{\frac{1}{3}}$ $(a)^{\frac{1}{3}}$ Ans $\frac{2}{1}$ $\frac{1}{3}$ $2\times3=6$
$1\times1=1$
$1\times3=3$ Com

12 Reduce $4^{\frac{1}{3}}$ and $5^{\frac{1}{4}}$ to a common index
$\frac{1}{3}$ $\frac{1}{4}$ $1\times4=4$
$3\times1=3$
$3\times4=12$ Com. index $\sqrt[12]{4^4}$ $\sqrt[12]{5^3}$ Ans

13 Reduce $a^{\frac{1}{2}}$ and $b^{\frac{1}{4}}$ to the common index 8
$\frac{1}{8}\div\frac{1}{2}=\frac{8}{1}\times\frac{1}{2}=\frac{8}{2}=4$ $\sqrt[8]{a^4}$ $\sqrt[8]{b^2}$ Ans
$\frac{1}{8}\div\frac{1}{4}=\frac{8}{1}\times\frac{1}{4}=\frac{8}{4}=2$

14 Reduce $2^{\frac{1}{2}}$ and $4^{\frac{1}{4}}$ to the common index 8
$\frac{1}{8}\div\frac{1}{2}=\frac{8}{1}\times\frac{1}{2}=\frac{8}{2}=4$ $\sqrt[8]{2^4}$ $\sqrt[8]{4^2}$ Ans
$\frac{1}{8}\div\frac{1}{4}=\frac{8}{1}\times\frac{1}{4}=\frac{8}{4}=2$

15 Remove a factor from $\sqrt{294}$ | $\sqrt{49}\times\sqrt{6}$
$7\sqrt{6}$ Ans

16 Remove a factor from $\sqrt{x^3-a^2x^2}$ | $\sqrt{x^2}\times\sqrt{x-a^2}$
$x\sqrt{x-a^2}$ Ans

17 ~~Remove a factor~~
Find the sum and difference of $\sqrt{16a^2x}$ and $\sqrt{4a^2x}$
$\sqrt{16a^2}\ \sqrt{x}$ / $4a\sqrt{x}$ $\sqrt{4a^2}\ \sqrt{x}$ / $2a\sqrt{x}$
$4a\sqrt{x}$ − $2a\sqrt{x}$ = $2a\sqrt{x}$ Dif
$4a\sqrt{x}$ + $2a\sqrt{x}$ = $6a\sqrt{x}$ Sum

18 Find the sum and Difference of $\sqrt[3]{192}$ and $\sqrt[3]{24}$
$\sqrt[3]{64}\times\sqrt[3]{3}$ / $4\sqrt[3]{3}$ $\sqrt[3]{8}\times\sqrt[3]{3}$ / $2\sqrt[3]{3}$
$4\sqrt[3]{3}$ + $2\sqrt[3]{3}$ = $6\sqrt[3]{3}$ Sum
$4\sqrt[3]{3}$ − $2\sqrt[3]{3}$ = $2\sqrt[3]{3}$ Dif

Radical Quantities by W. H.

19 Multiply $7\sqrt[3]{18}$ into $5\sqrt[3]{4}$

$35 \times 2\sqrt[3]{9} = 70\sqrt[3]{9}$ Ans

$7\sqrt[3]{18}$
$5\sqrt[3]{4}$
$35\sqrt[3]{72}$ $\sqrt[3]{8}\sqrt[3]{9} = 2\sqrt[3]{9}$

20 Multiply $4+2\sqrt{2}$ into $2-\sqrt{2}$

$4+2\sqrt{2}$
$2-2\sqrt{2}$
$-4\sqrt{2}-2\sqrt{4}$
$8+4\sqrt{2}$
$8 \quad 2\sqrt{4} = 8-4 = 4$ Ans

$(2\sqrt{4} = 4$

21 Multiply $a(a+\sqrt{c})^{\frac{1}{2}}$ into $b(a-\sqrt{c})^{\frac{1}{2}}$

$a\sqrt{a+\sqrt{c}}$
$b\sqrt{a-\sqrt{c}}$
$-\sqrt{a\sqrt{c}}-\sqrt{c}$
$ab \times a+\sqrt{a\sqrt{c}}$
Ans $ab \times a - \sqrt{c} = a^2b - \sqrt{c}$

22 Multiply $2(a+b)^{\frac{1}{n}}$ into $3(a+b)^{\frac{1}{m}}$

$2(a+b)^{\frac{m}{nm}}$
$3(a+b)^{\frac{n}{nm}}$
$6(a+b)^{\frac{m+n}{nm}}$ Answer

$\frac{1}{n} \quad \frac{1}{m}$
$1 \times m = m = \frac{m}{nm}$
$1 \times n = n = \frac{n}{nm}$
$n \times m = nm$ Common D

23 ~~Multiply~~ Divide $6\sqrt{54}$ by $3\sqrt{2}$

$\sqrt{27} = \sqrt{9} \times \sqrt{3}$
$2 \times 3\sqrt{3} = 6\sqrt{3}$ Ans

$6\sqrt{54}$
$3\sqrt{2}$
$2\sqrt{27}$

24 Divide $4\sqrt[3]{72}$ by $2\sqrt[3]{18}$

$4\sqrt[3]{72}$
$2\sqrt{18}$
$2\sqrt{4}$ Ans

25 Divide $\sqrt{2}$ by $\sqrt[3]{7}$

$\frac{1}{2} \quad \frac{1}{3}$
$1 \times 3 = 3$
$2 \times 1 = 2$
$2 \times 3 = 6$ Com D

$\sqrt[6]{2^3}$
$\sqrt[6]{7^2}$
$\sqrt[6]{\ }$ Ans

26 Divide $8\sqrt[9]{512}$ by $4\sqrt[3]{2}$

$8\sqrt[9]{512}$
$4\sqrt[9]{2}$
$2\sqrt{256}$

$\sqrt[9]{64} \times \sqrt[9]{4}$
$2 \times 4\sqrt[9]{4} = 8\sqrt[9]{4}$ Ans

27 Find the [cube] of $17\sqrt{21}$

$17\sqrt{21}$
$17\sqrt{21}$
$289\sqrt{21^2}$ Square
$17\sqrt{21}$
$4913\sqrt{21^3}$ cube Ans
Answer

28 Find the square of $5+\sqrt{2}$

$5+\sqrt{2}$
$5+\sqrt{2}$
$5\sqrt{2}+2$
$25+5\sqrt{2}$
$25+10\sqrt{2}+2 = 27+10\sqrt{2}$ Ans

Radical Quantities by Wm

29 Find the 4th power of $\frac{1}{6}\sqrt{6}$

$$\frac{1}{6}\sqrt{6}$$
$$\frac{1}{6}\sqrt{6}$$
$$\frac{1}{6}\sqrt{6^2}$$
$$\frac{1}{6}\sqrt{6}$$
$$\frac{1}{216}\sqrt{6^3}$$
$$\frac{1}{6}\sqrt{6}$$
$$\frac{1}{1296}\sqrt{6^4} = \frac{1}{1296} \times 36 = \frac{36}{1296} = \frac{1}{36}$$ Answer

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30 Find the cube of $\sqrt{x}-\sqrt{b}$

$$\sqrt{x}-\sqrt{b}$$
$$\sqrt{x}-\sqrt{b}$$
$$-\sqrt{bx} \quad +b$$
$$x-\sqrt{bx}$$
$$x-2\sqrt{bx}+b$$
$$\sqrt{x}-\sqrt{b}$$

$x\sqrt{x}-2\sqrt{b}x-b\sqrt{x}$ ~~[illegible]~~ $-x\sqrt{b}+2\sqrt{b}x-b\sqrt{b}$ Ans

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31 Find a factor which will make $\sqrt[3]{y}$ rational.

$$\sqrt[3]{y} \times \sqrt[3]{y^2} = \sqrt[3]{y^3} = y$$ Answer

32 Find a factor which will make $\sqrt{5}-\sqrt{x}$ Rational

$\sqrt{5}-\sqrt{x} \times \sqrt{5}+\sqrt{x}$

$$\sqrt{5}-\sqrt{x}$$
$$\sqrt{5}+\sqrt{x}$$
$$\sqrt{5x} \quad -x$$

Rational $5 - \sqrt{5x} - x$ Answer

---

33 Reduce $\frac{\sqrt{a}}{\sqrt{x}}$ to a fraction haveing a rational numerator

$$\frac{\sqrt{a}}{\sqrt{x}} = \frac{\sqrt{a} \times \sqrt{a}}{\sqrt{x} \times \sqrt{a}} = \frac{a}{\sqrt{ax}}$$ Answer

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34 Reduce $\frac{\sqrt{6}}{\sqrt{7}\times\sqrt{3}}$ to a fraction haveing a Rational Denominator

$$\frac{\sqrt{6}}{\sqrt{21}} = \frac{\sqrt{6}\times\sqrt{21}}{\sqrt{21}\times\sqrt{21}} = \frac{\sqrt{126}}{21}$$ Ans

Reduction of Equations by [illegible]

11 Reduce $\sqrt{5} \times \sqrt{x+2} = 2+\sqrt{5x}$

$$\sqrt{x+2} \times \sqrt{5} = \sqrt{5x+10}$$

$$(2+\sqrt{5x})(2+\sqrt{5x}) = 4+2\sqrt{5x}+2\sqrt{5x}+5x$$

$$5x+10 = 4+4\sqrt{5x}+5x$$

$$4+4\sqrt{5x} = 10$$

$$4\sqrt{5x} = 6$$

$$16 \times 5x = 36$$

$$80x = 36$$

$$x = \frac{36}{80} = \frac{9}{20} \text{ Ans}$$

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12 Reduce $\frac{x-ax}{\sqrt{x}} = \frac{\sqrt{x}}{x}$

$$x^2 - ax = x$$

$$(1-a)x = 1$$

$$x = \frac{1}{1-a} \text{ Ans}$$

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13 Reduce $\frac{\sqrt{x}+28}{\sqrt{x}+4} = \frac{\sqrt{x}+38}{\sqrt{x}+6}$

$$(\sqrt{x}+28)(\sqrt{x}+6) = x+34\sqrt{x}+168$$

$$(\sqrt{x}+38)(\sqrt{x}+4) = x+42\sqrt{x}+152$$

$$42\sqrt{x}+152 = 34\sqrt{x}+168$$

$$42\sqrt{x}-34\sqrt{x} = 168-152$$

$$8\sqrt{x} = 16$$

$$64x = 256$$

$$x = 4 \text{ Answer}$$

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14 Reduce $\sqrt{x}+\sqrt{a+x} = \frac{2a}{\sqrt{a+x}}$

[illegible]

Reduction of Equations

19 Reduce $\sqrt{4x+17} = 2\sqrt{x}+1$

$\sqrt{4x+17}$ — $2\sqrt{x}+1$, $2\sqrt{x}+1$, $2\sqrt{x}+1$, $4x+2\sqrt{x}$

$4x+17 = 4x+4\sqrt{x}+1$

$4\sqrt{x}+1=17$

$4\sqrt{x}=17-1=16$

$16 \,|\, 16x = 256$ (16×16)

$x = 16$ Ans

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20 Reduce $\frac{\sqrt{6x}-2}{\sqrt{6x}+2} = \frac{4\sqrt{6x}-9}{4\sqrt{6x}+6}$

$4\sqrt{6x}-9$
$\sqrt{6x}+2$
$+8\sqrt{6x}-18$
$4\times 6x-9\sqrt{6x}$
$24x-\sqrt{6x}-18$

$4\sqrt{6x}+6$
$\sqrt{6x}-2$
$-8\sqrt{6x}-12$
$4\times 6x+6\sqrt{6x}$
$24x-2\sqrt{6x}-12$

$-\sqrt{6x}+2\sqrt{6x} = -12+18$

$-\sqrt{6x}$ — 12

$\sqrt{6x}$ — 6, 6

$6 \,|\, 6x = 36$

$x = 6$ Answer

By Evolution Art. 299

Prob 1 What number is that the 4th part of whose square being subtracted from 8 leaves a remainder equal to 4 — Ans 4

12 Then $8-\frac{x^2}{4} = 4$

$32-x^2 = 16$

$-x^2 = 16-32$

$-x^2 = -16$

$x = 4$ Answer

W. H. McCormick

Reduction of Equations by evolution

7 What two numbers ar those whose sum is to the greater as 10 to 7 and whose sum multiplied into the less produces 270

$10x$ $7x$
$7x$
$3x$ less

$(7x+3x)\times 3x = 270$
$3x$
$10x^2$ $9x$
$30 \,|\, 30x^2 = 270$
$x^2 = 9 = x = 3$ Ans

$7x = 7\times 3 = 21$ greater
$3x = 3\times 3 = 9$ less

8 What two numbers are those whose difference is to the greater as 2 to 9 and the difference of whose squares is 128 — Ans 18 and 14

$9x$ $9x$ the great
$2x$
$7x$ less

$7x$
$7x$
$49x^2$

$9x$
$9x$
$81x^2$
$49x^2$
$32 \,|\, 32x^2 = 128$
$x^2 = 4$
$x = 2$

$9x = 9\times 2 = 18$
$7x = 7\times 2 = 14$ An

9 It is required to divide the number 18 into 2 such parts that ~~that~~ the squares of whose parts may be to each other as 25 to 16 — A 10 and 8

Sup x greater
$18-x$ less

$x^2 : (18-x)^2 :: 25 : 16$
$16x^2 = 25\times(18-x)^2$
$4x = 5\times(18-x)$
$4x = 90 - 5x$
$5x$
$9 \,|\, 9x = 90$ greater
$x = 10$

10 It is required to divide the number 14 into two such parts that the quotient of the greater divided by the less may be to the quotient of the less divided by the greder as 16 : 9 — 8 and 6 Answ

x greater
$14-x$ less

$\frac{x}{14-x} : \frac{14-x}{x} :: 16 : 9$

$\frac{9}{14-x} = \frac{224-16x}{x}$

$224-16x$
$14-x$
$-224x+16x^2$
$3136-224x$

$9x^2 = \sqrt{3136-448x+16x^2}$
$3x = 56 - 4x$
$3x+4 = 56$
$7 \,|\, 7x = 56$
$x = 8$ greter

14
8
6 less

Equations By Wm H

11 What two numbers are as 5 to 4 the sum of whose cubes is 5103 — Ans 15 and 12

$$5x \quad 4x$$
$$5x \quad 4x$$
$$25x^2 \quad 16x^2$$
$$5x \quad 4x$$
$$125x^3 + 64x^3 = 5103$$
$$64x$$
$$189 \,|\, 189x^3 = 5103$$
$$x^3 = 27 = x = 3$$

4 × 3 = 12 less 5 × 3 = 15 greater

12 Two travellers A and B set out to meet each other A leaving the town C at the same time that B left D They travelled the direct road between C and D and on meeting it appeared that A had travelled 18 miles more than B and that A could haveing gone B's distance in $15\frac{3}{4}$ days but B would have been 28 days in going A's distance Required the distane between C and D 72 A's 54 B

Sup x the number of miles A traveld
The $x-18$ the number B traveled

$\frac{x-18}{15\frac{3}{4}}$ A's dayly Then $x : x-18 :: \frac{x-18}{15\frac{3}{4}} : \frac{x}{28}$

$\frac{x}{28}$ B

$$\frac{x^2}{28} = \begin{array}{r} x-18 \\ x-18 \\ -18x+324 \\ x^2-18x \\ \hline x^2-36x+324 \end{array}$$

$$\frac{x^2}{28} = \frac{x^2-36x+324}{15\frac{3}{4}}$$

$$\frac{63x^2}{4} = 28x^2-1008x+9072$$

$$7 \,|\, 63x^2 = 112x^2-4032x+36288$$
$$9x^2 = 16x^2-576x+5184$$

$$3x = 4x \text{ ——— } 72$$
$$4x-72 = 3x$$
$$4x-3x = 72$$
$$x = 72 \text{ A's distane}$$

$$72 - 18 = 54 \text{ B} \qquad 72 + 54 = 126 \text{ Proof}$$

Equations Continued 1844

13 Find two numbers which are to each other as 8 to 5 and whose product is 360 Ans 24 and 15

$8x \times 5x = 360$

$40 \,|\, 40x^2 = 360$

$x^2 = 9 = x = 3$

$\frac{8}{3}$ 24 and $\frac{5}{3}$ 15 Ans

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14 A gentleman bought two pieces of silk which together measured 36 yds each of them cost as many shillings by the yd as there were yds in the piece and there whole pieces were as 4 to 1 What were the lengths of the pieces Ans 24 and 12 yds

x sup, x, x^2

$36 - x$ sup, $36 - x$, $96x + x^2$

1296 $36x$

$x^2 : 1296 - 72x + x^2 :: 4 : 1$

4

$x^2 = 5184 - 288x + 4x^2$

$x = 72 — 2x$

$3 \,|\, 3x = 72$

$x = 24$ greater

36
24
12 less

---

15 Find two numbers which are to each other as 3 to 2 and the difference of whose fourth powers is to the sum of their cubes as 26 to 7 Ans 6 and 4

$3x$
$3x$
$9x^2$
$3x^2$
$27x^3$
$3x$
$81x^4$
$16x^4$
$65x^4$ difference

$2x$
$2x$
$4x^2$
$2x$
$8x^3$
$2x$
$16x^4$

$27x^3$
$8x^3$
$35x^3$ Sum out

$65x^4 :: 35x^3 : 26 : 7$

$x^2 \,|\, 455x^4 = 910x^3$

$455 \,|\, 455x = 910$

$x = 2$

$3x = 6$
$2x = 4$ Answer

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16 Several gentlemen made an excursion each taking the same sum of money each had as many servants attending him as there were gentlemen the number of $ each had was double the number of all the servants and the whole sum of money taken out was 3456 $ How many men were there Ans 12

Sup x the men $\frac{x}{x^2}$

$\frac{x^2}{2x^3}$ the Servants

the cube extracted $2 \,|\, 2x^3 = 3456$

$x^3 = 1728 = x = 12$ Ans

IV A detachment of soldiers from a regiment being ordered to march on a particular service each company furnishing four times as many as there were companys in the whole regiment but these being found insufficient each company furnished three men more When their numb was to be increased in the ratio of 17 to 16 How many companys were there in the regiment Ans 12

Sup x the number of companys

$x \times 4 = 4x$ in one company $\quad x \times 3 = 3x$ increase

$\frac{x}{4x^2}$ the whole

$4x^2 + 3x :: 4x^2 :: 17 : 16$

$x \,|\, 64x^2 + 48x = 68x^2$

$64x + 48 = 68x$

$68x = 64x + 48$

$68x - 64x = 48$

$4 \,|\, 4x = 48$

$x = 12$ Answer

Quadratick Equations

Reduce $3x^2 - 9x - 4 = 80$ $\quad$ Ans $x = 7$ or 4

$3 \,|\, 3x^2 - 9x = 84$

$x^2 - 3x = 28$

$x^2 - 3x + \frac{9}{4} = 28 + \frac{9}{4} = \frac{121}{4}$

$x - \frac{3}{2} = \pm \sqrt{\frac{121}{4}} = \frac{11}{2}$

$x = \frac{3}{2} \pm \frac{11}{2} = 7$ or -4 Ans

2 Reduce $4x - \frac{36 - x}{x} = 46$ $\quad$ Ans 12 or $-\frac{3}{4}$

$4 \,|\, 4x^2 - 36 - x = 46x$

$4x^2 \,|\, 4x^2 - 45x = 36$

$x^2 - \frac{45x}{4} = 9$

$x^2 - \frac{45}{4}x + \frac{2025}{64} = \frac{2025}{64} + 9 = \frac{2601}{64}$

$x - \frac{45}{8} = \pm\sqrt{\frac{2601}{64}} = \frac{51}{8}$

$x = \frac{45}{8} \pm \frac{51}{8} = \frac{96}{8} = 12$ or $\frac{3}{4}$ Ans

Equation Continued

22 Reduce $x^{\frac{6}{5}} + x^{\frac{3}{5}} = 756$

$x^{\frac{6}{5}} + x^{\frac{3}{5}} + \frac{1}{4} = 756 + \frac{1}{4} = \frac{3025}{4}$

$x^{\frac{3}{5}} + \frac{1}{2} = \sqrt{\frac{3025}{4}} = \frac{55}{2}$

$x^{\frac{3}{5}} = -\frac{1}{2} + \frac{55}{2} = 27$

$x^{\frac{1}{5}} = 3$

$x^{5} = 3 \; x = 243$ Ans

23 Reduce $\sqrt{2x+1} + 2\sqrt{x} = \frac{21}{\sqrt{2x+1}}$

$2x+1+2\sqrt{2x^2+x} = 21$

$2\sqrt{2x^2+x} = 21-1-2x = 20-2x$

$2\sqrt{2x^2+x} = 20-2x$

$4 \times 2x^2+x \qquad \frac{20 \quad 2x}{-40x+4x^2}$

$8x^2+4x = 400-80x+4x^2$

$8x^2+4x+80x-4x^2 = 400$

$4x^2+84x = 400$

$x^2+21x = 100$

$x^2+21x+\frac{441}{4} = 100+\frac{441}{4} = \frac{841}{4}$

$x+\frac{21}{2} = \sqrt{\frac{841}{4}} = \frac{29}{2}$

$x = -\frac{21}{2} \pm \frac{29}{2} = 4$ Answer

24 Reduce

$2\sqrt{x-a} + 3\sqrt{2x} = \frac{7a+5x}{\sqrt{x-a}}$

$2x-2a+3\sqrt{2x^2-2ax} = 7a+5x$

$3\sqrt{2x^2-2ax} = 7a+5x-2x+2a$

$\frac{9a+3x}{9a+3x}$

$9 \times 2x^2-2ax \qquad \frac{9a+3x}{81a^2+27ax}$

$18x^2-18ax \qquad \frac{81a^2+27ax}{81a^2+54ax+9x^2}$

$9x^2-72ax = 81a^2$

$x^2-8ax = 9a^2$

$x^2-8ax+\frac{64}{4} = \frac{64}{4}+9a^2 = 100a^2$

$x-\frac{8}{2} = \sqrt{100a^2} = 10a$

$x = \frac{8}{2} \pm 10a = 9a$ Answer

25 Reduce

$x+16-7\sqrt{x+16} = 10-4\sqrt{x+16}$

$10-4\sqrt{x+16} = x+16-7\sqrt{x+16}$

$\frac{7\sqrt{x+16}}{3\sqrt{x+16}} = \frac{-10}{x+6}$

$\frac{x+6}{6x+36}$

$9 \times x+16 \qquad \frac{x^2+6x}{}$

$9x+144 = x^2+12x+36$

$x^2+12x+36 \; 9x+144$ change

$x^2+12x-9x = 144-36$

$\frac{-9x}{x^2+3x} = \frac{36}{108}$

$x^2+3x+\frac{9}{4} = 108+\frac{9}{4} = \frac{441}{4}$

$x+\frac{3}{2} = \sqrt{\frac{441}{4}} = \frac{21}{2}$

$x = -\frac{3}{2} \pm \frac{21}{2} = 9$ Ans

26 Reduce $\sqrt{x^5} + \sqrt{x^3} = 6\sqrt{x}$

$\div \sqrt{x}$ $\sqrt{x^5} + \sqrt{x^3} = 6\sqrt{x}$

$\sqrt{x^4} + \sqrt{x^2} = 6$

$x^2 + x = 6$

$x^2 + x + \frac{1}{4} = 6 + \frac{1}{4} = \frac{25}{4}$

$x + \frac{1}{2} = \sqrt{\frac{25}{4}} = \frac{5}{2}$

$x = -\frac{1}{2} \pm \frac{5}{2} = 2$ Ans

Quadratic Equations

27 Reduce $\frac{4x-5}{x} - \frac{3x-7}{3x+7} = \frac{9x+23}{13x}$

$156x^3+169x^2-455x-39x^3+91x^2=27x^3+132x^2+161x$

$156x^2+169x-455-39x^2+91x=27x^2+132x+161$

$156x^2+169x-39x^2+91x-27x^2-132x=161+455$

$90x^2+128x=616$

$x^2+\frac{64x}{45}=\frac{308}{45}$

$x^2+\frac{64x}{45}+\frac{4096}{8100}=\frac{308}{45}+\frac{4096}{8100}=\frac{59536}{8100}$

$x+\frac{64}{90}=\sqrt{\frac{59536}{8100}}=\frac{244}{90}$

$x=-\frac{64}{90}+\frac{244}{90}=2$ Ans

28 Reduce $\frac{3}{6x-x^2}+\frac{6}{x^2+2x}=\frac{11}{5x}$

$15x^2+30x+180x-30x^2=66x^2-11x^3+132x-22x^2$

$15x+30+180-30x=66x-11x^2+132-22x$

$15x-30x-66x+11x^2+22x=132-180-30$

$11x^2-59x=-78$

$x^2-\frac{59x}{11}=-\frac{78}{11}$

$x^2-\frac{59x}{11}+\frac{3481}{484}=\frac{3481}{484}-\frac{78}{11}=\frac{49}{484}$

$x-\frac{59}{22}=\sqrt{\frac{49}{484}}=\frac{7}{22}$

$x=\frac{59}{22}+\frac{7}{22}=3$ Answer

29 Reduce

$(x-5)^3-3(x-5)^{\frac{3}{2}}=40$

$(x-5)^3-3(x-5)^{\frac{3}{2}}+\frac{9}{4}=40+\frac{9}{4}=\frac{169}{4}$

$\sqrt{(x-5)^3}-\frac{3}{2}=\sqrt{\frac{169}{4}}=\frac{13}{2}$

$(x-5)^{\frac{3}{2}}=\frac{3}{2}+\frac{13}{2}=8$

$\sqrt{(x-5)^3}=8$

$(x-5)^3=64$

$x-5=4$

$x=4+5=9$ Ans

30 Reduce

$x+\sqrt{x+6}=2+3\sqrt{x+6}$

$2+3\sqrt{x+6}=x+\sqrt{x+6}$

$3\sqrt{x+6}-\sqrt{x+6}=x-2$

$2\sqrt{x+6}$

$4x+24$

$x^2-4x+4=4x+24$

$x^2-4x-4x=24-4=20$

$x^2-8x=20$

$x^2-8x+16=36$

$x-4=\sqrt{36}=6$

$x=4+6=10$ Ans

Equations Contin. Problems

Pr 2^d The ages of two brothers are such that their sum is 45 years and their product 500 What is the age of each

$45-x$ youngest
x eldest
$45x-x^2=500$
$x^2-45x=-500$
$x^2-45x+\frac{2025}{4}=\frac{2025}{4}-500=\frac{25}{4}$
$x-\frac{45}{2}=\sqrt{\frac{25}{4}}=\frac{5}{2}$
$x=\frac{45}{2}\pm\frac{5}{2}=25$ and $\frac{45}{20}$ Ans

6^th To find two numbers whose difference shall be 12 and the sum of their squares 1424
x $x+12$ the numbers
$x^2+(x+12)^2=1424$
$x^2+24x+144$
$2x^2+24x+144=1424$
$2)2x^2+24x=1280$
$x^2+12x=640$
$x^2+12x+36=640+36=676$
$x+6=\sqrt{676}=26$
$x=-6\pm26=20$ less $\frac{20}{12}{32}$ greatest Ans

7^th Two persons drew prizes in a lottery the difference of which is 120 £ and the greater is to the less as the less to 10 What are the prizes Ans 9 and 1
greater less
$x+120:x::x:10$
$10x+1200=x^2$
$x^2-10x=1200$
$x^2-10x+25=1225$
$x-5=\sqrt{1225}=35$
$x=5\pm35=40$ less $\frac{120}{160}$ greater

8^th What two numbers are those whose sum is 6 and the sum of their cubes 72 x great $6-x$ less
$x^3+(6-x)^3=72$
$6-x$
$-6x+x^2$
$36+6x$
$36-12x+x^2$
$6-x$
$-36x+12x^2-x^3$
$216-72x+6x^2$
$216-108x+18x^2-x^3+x^3=72$
$18)18x^2-108x=72-216=-144$
$x^2-6x=-8$
$x^2-6x+9=9-8=1$
$x-3=\sqrt{1}$
$x=3\pm1=2$ and 4 Ans

9 Divide the number 56 into two such parts that their product shall be 640
$x\times56-x$
$56x-x^2=640$
$x^2-56x=-640$
$x^2-56x+784=784-640=144$
$x-28=\sqrt{144}=12$
$x=28\pm12=40$ or 16 Answer

Equations Contin

Prob (13 A and B distributed 1200 $ each among a certain number of persons A relieved 40 persons more than B and B gave each individual 5 $ more than A How many were relieved by A and B

Sup x the number B relieved
$x+40$ A relieved

$$\frac{1200}{x} - \frac{1200}{x+40} = 5 \qquad \text{Ans } 120 \text{ and } 80$$

$$1200x + 48000 - 1200x = 5x^2 + 200x$$

$$5 \,|\, 5x^2 + 200x = 48000$$

$$x^2 + 40x = 9600$$

$$x^2 + 40x + 400 = 9600 + 400$$

$$x + 20 = \sqrt{10000} = 100 \quad A$$

$$x = -20 \pm 100 = 80 \, B \qquad 80 + 40 = 120$$

14 Find 2 numbers whose sum is 10 and the sum of their squares 58

x greater, x^2 — Ans 7 and 3

$$10 - x$$
$$10 - x$$
$$-10x + x^2$$
$$100 - 10x$$
$$100 - 20x + x^2$$
$$x^2$$
$$100 - 20x + 2x^2 = 58$$
$$2 \,|\, 2x^2 - 20x = 58 - 100 = -42$$
$$x^2 - 10x = -21$$
$$x^2 - 10x + 25 = -21 + 25 = 4$$
$$x - 5 = \sqrt{4} = 2$$
$$x = 5 \pm 2 = 7 \text{ greater} \quad \frac{10}{3} \text{ less}$$

15 Several gentlemen made a purchase in company for 175 $ two of them having withdrawn the bill was paid by the others each furnishing 10 $ more than would have been his equal share if the bill had been paid by all the company What was the number in the company at first — Ans 7

Sup x = the number at first

$$\frac{175}{x-2} - \frac{175}{x} = 10$$

$$175x - 350 - 175x = 10x^2 - 20x$$

$$10 \,|\, 10x^2 - 20x - 175x + 175x = 350$$

$$x^2 - 2x = 35$$

$$x^2 - 2x + 1 = 35 + 1 = 36$$

$$x - 1 = \sqrt{36} = 6$$

$$x = 1 + 6 = 7 \text{ Answer}$$

Equations Continued

19 Three persons A B and C purchase a horse for 100 $ but neither is able to pay for the whole the payment would require the whole of A's money together with ½ of B's or the whole of B's with ⅓ of C's or the whole of C's with ¼ of A's how much money had each

x = A's
y = B's
z = C's
a = 100

$x + \frac{1}{2}y = a$
$y + \frac{1}{3}z = a$
$z + \frac{1}{4}x = a$
$4z + x = 4a$
$3y + z = 3a$
$2x + y = 2a$
$x = 4a - 4z$
$x = 2a - \frac{y}{2}$
$\frac{2a - y}{2} = 4a - 4z$
$2a - y = 8a - 8z \times 3$
$3y = 3a - z$
$6a - 3y = 24a - 24z$
$3y = 3a - z$
$6a = 27a - 25z$
$25z = 27a - 6a$
$25z = 21a = 21 \times 100 = 2100$
$25)\ 25z = 2100$
$z = 84$

$4 \times 84 + x = 4a$
$336 + x = 4a = 400$
$x = 400 - 336$
$x = 64$
$2 \times 64 + y = 2a = 200$
$y = 200 - 128$
$y = 72$ $x = 64$ $z = 84$
Answer

20 The sum of the distance which 3 persons A B and C have travelled is 62 miles A's distance is equal to 4 times C's added to twice B's and twice A's added to 3 times B's is equal to 17 times C's What are the respective distances

x = A's
y = B's
z = C's

$x + y + z = 62$
$x = 4z + 2y$
$2x + 3y = 17z$
$x = 62 - y - z$
$x = 2y + 4z$
$x = \frac{17z - 3y}{2}$
$\frac{17z - 3y}{2} = 2y + 4z$
$17z - 3y = 4y + 8z$
$4)\ 4z = 62 - y - z$
$17z - 8z = 4y + 3y$
$9z = 7y$
$4z + z = -1y - y + 62$
$5z = -2y + 62$

$9z = 7y \times 5$
$5z = (62 - 2y) \times 9$
$45z = 558 - 18y$
$45z = 35y$
$0 = 558 - 53y$
$53)\ 53y = 558$
$y = 9$ B

$18 + 4z = 62 - 9 - z$
$5z = 62 - 9 - 18$
$5)\ 5z = 35$
$z = 7$ C

$x = (2 \times 9) + (4 \times 7)$
$x = 18 + 28$
$x = 46$ A

Continued By [illegible]

26 If a certain number be divided by the product of its two digits the quotient will be 2 and if 27 be added to the number the digits will be inverted what is the number Ans 96

x the right hand
y the left hand

$x \times 10 = 10x + y = 2$

$10x + y + 27 = 10y + x$
$10x + y = 2xy$

$10x - x = 10y - y - 27$
$9)\ 9x = 9y - 27$
$x = y - 3$

$10(y-3) + y = 2y(y-3)$
$10y - 30 + y = 2y^2 - 6y$
$2y^2 - 6y - 10y = 30 + y$
$2)\ 2y^2 - 17y = -30$
$y^2 - 17y = -15$
$y^2 - 17y + \frac{289}{16} \quad \frac{289}{16} - 15 = \frac{49}{16}$
$y - \frac{17}{4} = \sqrt{\frac{49}{16}} = \frac{7}{4}$
$y = \frac{17}{4} + \frac{7}{4} = 6$ right hand

$x = 6 - 3$
$x = 3$
$y = 6$

$10x + y = 10(3) + 6 = 36$ Answer

27 There are two numbers such that if the less be taken from 3 times the greater the remainder will be 35 and if 4 times the greater be divided by 3 times the less +1 the quotient will be equal to the less What are the numbers Ans 13 and 4

Let x = greater
y = less

$3x - y = 35$
$\frac{4x}{3y+1} = y$

$4x = 3y^2 + y \times 3$
$3x = 35 + y \times 4$
$12x = 9y^2 + 3y$
$12x = \quad\quad + 4y + 140$
$0 = 9y^2 - y + 140$
$y = 4$ less
Ans $x = 13$ greater

$9)\ 9y^2 - y = 140$
$y^2 - \frac{y}{9} = \frac{140}{9}$
$y^2 - \frac{y}{9} + \frac{1}{324} = \frac{140}{9} + \frac{1}{324} = \frac{5041}{324}$
$y - \frac{1}{18} = \sqrt{\frac{5041}{324}} = \frac{71}{18}$
$y = \frac{1}{18} + \frac{71}{18} = 4$ less

$3x - 4 = 35$
$3)\ 3x = 39$
$x = 13$ greater

28 There is a fraction such that if 3 be added to the numerator the value of the fraction will be $\frac{1}{3}$ but if 1 be subtracted from the denominator the value will be $\frac{1}{5}$ what is the fraction Ans $\frac{4}{21}$

Let x = numerator
y = denominator

$\frac{x+3}{y} = \frac{1}{3}$
$\frac{x}{y-1} = \frac{1}{5}$
$3x + 9 = y$
$5x - y = 1$

$3x - y = -9$
$5x - y = -1$
$2)\ 2x = 8$
$x = 4$ numerator

$\frac{x}{y-1} = \frac{1}{5} = \frac{4}{y-1} = \frac{1}{5}$
$20 = y - 1$
$y = 21$ denominator

Equations Continued

$2x+y+z=2a$
$5y+z-x=5b$
$x+y+z=2c$

$z=2a-2x-y$
$z=5b+x-5y$
$z=2c-x-y$

$2a-2x-y=5b+x-5y$ } two equations
$2a-2x-y=2c-x-y$

$2a-5b=3x-4y$
$2a-2c=x$ $\quad 2\times120-2\times95=50$
$240-350=150-4y$ $\quad 2a=240$, $5b=350$
$4)4y=260$
$y=65$

$2x+y+z=2a$
$100+65+z=240$
-165
$z=75$

$z=75$
$x=50$
$y=65$
Ans

32 What two numbers are those whose difference sum and product are as the numbers 2. 3 and 5

Ans 10 and 2

Let x = one
y = other

$x-y : x+y :: 2 : 3$
$x+y : xy :: 3 : 5$
$3x-3y=2x+2y$
$5x+5y=3xy$
$5x-3xy=-5y$
$3x-2x=5y=x=5y$

$3x-2x=10$
$x=10$ greater

$5y-15y^2=-5y$
$25-15y=-5$
$15)-15y=-30$
$y=2$ less

33 A vintner sold at one time 20 dozen of port wine and 30 doz of sherry and for the whole received 120 guineas at another time he sold 30 dozen of port and 25 dozen of sherry at the same price as before and for the whole received 140 guineas what was the price of a dozen of each sort of wine

Sup x = price of port pr doz
y = do sherry

$20x+30y=120\times3$
$30x+25y=140\times2$
$60x+90y=360$
$60x+50y=280$
$40y=80$
$y=2$ price of sherry

$20x+60=120$
$20x=120-60$
$20)20x=60$
$x=3$ price port

34 A merchant having mixed a certain number of gallons of brandy and water found that if he had mixed 6 galls more of each he would have put into the mixture 7 galls of brandy for every 6 of water but if he had mixed 6 less of each he would have put in 6 gallons of brandy for every 5 of water how many go of each did he mix

Ans 78 brandy 66 water

Equations By Wm

Let x = brandy
y = water

$x+6 : y+6 :: 7 : 6$
$x-6 : y-6 :: 6 : 5$

$6x+36 = 7y+42 \times 5$
$5x-30 = 6y-36 \times 6$
$30x+180 = 35y+210$
$30x+180 = 36y-216$
$+360 = y-426 = y = 426-360$
-360
$y = 66$ water

$5x-30 = 396-36$
$5x = 396+30-36$
30
426
136
$5x = 390$
$x = 78$ Brandy

35 What fraction is that whose numerator being doubled and the denominator increased by 7 the value becomes $\frac{2}{3}$ but the denominator being doubled and the num. increased by 2 the value becomes $\frac{3}{5}$

Let x = numerator
y = denom.

$\frac{2x}{y+7} = \frac{2}{3} = 6x = 2y+14$ — Ans $\frac{4}{5}$

$\frac{x+2}{2y} = \frac{3}{5} = 5x+10 = 6y$

$2y = 6x-14 \times 3$
$6y = 5x+10$
$6y = 18x-42$
$0 = 13x-52$
$13 \mid 13x = 52$
$x = 4$ num.

$6y = 20+10$
$6 \mid 6y = 30$
$y = 5$ den.

36 A person expended 30 cts in apples and pears giveing a cent for 4 apples and a cent for 5 pears, he afterward parts with ½ of his apples and ⅓ of his pears the cost of which was 13 cents how many did he buy of each — Ans 72 apples and 60 pears

Let x = apples
y = pears

If $4 : 1 : x = \frac{x}{4}$
$5 : 1 : y = \frac{y}{5}$
$\frac{x}{4} + \frac{y}{5} = 30$

If $4 : 1 : \frac{x}{2} = \frac{x}{8}$
$5 : 1 : \frac{2y}{3} = \frac{2y}{15}$

$\frac{x}{8} + \frac{2y}{15} = 13$
$15x + 16y = 1560$

1st equation
$\frac{x}{4} + \frac{y}{5} = 30$
$5x + 4y = 600 \times 3$
$15x + 12y = 1800$
$15x + 8y = 1560$
$4 \mid 4y = 240$
$y = 60$ Pears

$15x + 8 \times 60 = 1560$
$15x = 1560 - 480$
-480
$15 \mid 15x = 1080$
$x = 72$ Apples

Ratio Continued.

$$\begin{array}{r} 5x+7 : 2x-3 \\ x+2 : x+6 \\ \hline 10x+14 : 12x-18 \\ 5x^2+7x : 2x^2-3x \\ \hline 5x^2+17x+14 : 2x^2+9x-18 \end{array} \qquad \tfrac{1}{2}x+3 = \frac{x+6}{2}$$

$$\frac{10x^2+34x+28}{2x^2+9x-18}$$ A ratio of greater inequality

8 What is the ratio compounded of $x+y : a$ and $x-y : b$ and $b : \frac{x^2-y^2}{a}$ Ans

$$\begin{array}{r} x+y : a \\ x-y : b \\ \hline xy-y^2 : ab \\ x^2+xy \\ \hline x^2-y^2 : ab \\ ab : x^2-y^2 \\ \hline abx^2-aby^2 : abx^2-aby^2 \end{array} \qquad \begin{array}{l} b : \frac{x^2-y^2}{a} \\ ab : x^2-y^2 \end{array}$$

A ratio of equality

9 What is the ratio compounded of 7 : 5 and the duplicate ratio of 4 : 9 and the triplicate ratio of 3 : 2

$$\begin{array}{r} 7 : 5 \\ 16 : 81 \\ \hline 112 : 405 \\ 27 : 8 \\ \hline 3024 : 3240 \\ 216 \quad 3024 : 3240 \\ 14 : 15 \end{array}$$

10 What is the ratio compounded of 3 : 7 and the duplicate ratio of x : y and the subduplicate ratio of 49 : 9 Ans $x^2 : y^2$

$$\begin{array}{r} 3 : 7 \\ x^2 : y^2 \\ \hline 3x^2 : 7y^2 \\ 7 : 3 \\ \hline 21 \quad 21x^2 : 21y^2 \\ x^2 : y^2 \end{array}$$ Ans

Proportion

Problem

There are two numbers whose product is 135 and the difference of their squares is to the square of their differences as 4 to 1 What are the numbers Ans 15 and 9

Sup x = one
y = other

$xy = 135$

$x^2 - y^2 : (x-y)^2 :: 4 : 1$

$x^2 - y^2 : x^2 - 2xy + y^2 :: 4 : 1$

$x - y \mid 2x^2 - 2xy : x^2 - 2xy + y^2 :: 5 : 1$

$2x : x - y :: 5 : 1$

$5x - 5y = 2x$

$3 \mid 3x = 5y$

$x = \frac{5y}{3} \times y = 135$

$5y^2 = 135$

$5 \mid 5y^2 = 405$

$y^2 = 81 = y = \sqrt{81} = 9$

$3x = 5y$
$3 \mid 3x = 45$
$x = 15$
$y = 9$ (Ans)

11 What two numbers are those whose diffe sum and product ar as the numbers 2, 3 and 5 respectively Ans 10 and 2

Sup x = one
y = other

$x - y : x + y : 2 : 3$
$x + y : xy : 3 : 5$

$x - y : x + y : 2 : 3$
$x + y$

$2x : x + y : 5 : 3 = 6x = 5x + 5y$
$ - 5x$
$ x = 5y$

$5x + 5y = 3xy$

$y \mid 25y + 5y = 15y^2$

$25 + 5 = 15y$

$15 \mid 15y = 30$
$y = 2$

$x = 5y = x = 2 \times 5 = 10$

$y = 2$
$x = 10$
Ans

12 Divide the number 24 into two such parts that their product shall be to the sum of their squares as 3 to 10 Ans 18 and 6

Proportion

2. Let x = greater, $24-x$ = less

$24x-x^2 : (24-x)^2+x^2 :: 3 : 10$

$24x-x^2 : 576-48x+x^2+x^2 :: 3 : 10$

$24x-x^2 : 576-24x :: 3 : 16$

$384x-16x^2 = 1728$

$16)\ 16x^2-384x = -1728$

$x^2-24x = -108$

$x^2-24x+144 = 144-108$

$x-12 = \sqrt{36} = 6$ 24 − 18 = 6 less

$x = 12+6 = 18$ greater

13. In a mixture of rum and brandy the difference between the quantities of each is to the quantity of brandy as 100 is to the number of gallons of rum and the same difference is to the quantity of rum as 4 to the number of galls of brandy. How many galls of each. Ans 25 rum 5 brandy

x = rum, y = brandy

Solution $x-y : y :: 100 : x$

$x-y : x :: 4 : y$

$x : y :: 4 : y-4$

$x : y :: 100 : x$

$x^2 = 100y$, $xy - 4x = 4x$ …

$4)\ 4x = 100y-400$

$x = 25y-100$

$x^2 = 100y$ first equation

$(25y-100)^2 = 100y$

$625y^2-5000y+10000 = 100y$

$625y^2-5000y-100y = -10000$

$600)\ 600y^2-5000y = -10000$

$y^2-\frac{50y}{6} = -\frac{100}{6}$

$y^2-\frac{50}{6}y+\frac{2500}{144} = \frac{2500}{144}-\frac{100}{6} = \frac{100}{144}$

$y-\frac{50}{12} = \sqrt{\frac{100}{144}} = \frac{10}{12}$

$y = \frac{50}{12}+\frac{10}{12} = 5$ Brandy

$x = 25y-100 = x = 125-100$

$x = 25$ Rum

Continued

14 There are two numbers which are to each other as 3 to 2 if 6 be added to the greater and subtracted from the less the sum and remainder will be to each other as 3 to 1 what are the numbers

Let x = one
y = other

$x : y :: 3 : 2$
$x+6 : y-6 :: 3 : 1$

$x+y : y-6 :: 4 : 1$
$x+y : y :: 5 : 2$

$x+y = 4y - 24$
$x = 3y - 24$

$2x = 3y$ First Equation

$3y - 24 \times 2 = 3y$
$6y - 48 = 3y$
$6y - 3y = 48$
$3 | 3y = 48$
$y = 16$ Less

$2x = 3y = 3 \times 16$
$2 | 2x = 48$
$x = 24$ Greater

$y = 16$
$x = 24$ Ans

15 There are two numbers whose product is 320 and the difference of their cubes is to the cube of their difference as 61 to 1 What are the numbers

Let x = one
y = other

$xy = 320$
$x^3 - y^3 : (x-y)^3 :: 61 : 1$

Ans 20 and 16

$x^2 - xy + y^2$
$x - y$
$x^2 - 2xy + y^2$
$x - y$

$x^3 - 2x^2y + xy^2$
$- x^2y + 2xy^2 - y^3$

$x^3 - y^3 : x^3 - 3x^2y + 3xy^2 - y^3 :: 61 : 1$

$x-y | 3x^2y - 3xy^2 : (x-y)^3 :: 60 : 1$

$3xy : (x-y)^2 :: 60 : 1$

$3xy = 960$ First equation

$960 : x^2 - 2xy + y^2 :: 60 : 1$

$60 | 60x^2 - 120xy + 60y^2 = 960$

$x^2 - 2xy + y^2 = 16$

$y^2 - 2xy = 16 - x^2$

$y^2 - 2xy + x^2 = 16 - x^2 + x^2 = 16$

$y - x = 4$

$y = 4 + x = y = 4 + 16$

$y = 20$
$x = 16$ Ans

$xy = 320$
$x + 4 \times x = 320$
$x^2 + 4x + 4 = 324$
$x + 2 = \sqrt{324} = 18$
$x = 18 - 2 = 16$
$x = 16$

16 There are two numbers which are to each other in the duplicate ratio of 4 to 3 and 24 is a mean proportional between them what are the numbers Ans 32 and 18

Let x = one, y = other

$\sqrt{xy} = 24$

$xy = 576$

$x : y :: 16 : 9$

$x+y : y :: 25 : 9$

$9x + 9y = 25y$

$9x = 16y$

$x = \frac{16y}{9}$

substituting value of x in first equation

$\frac{16y^2}{9} = 576$

$16y^2 = 5184$

$y^2 = 324$

$y = \sqrt{324} = 18$

$9x = 16y = 288$

$9x = 288$

$x = 32$

$y = 18$
$x = 32$
Ans

Progression By Wm

Rule

1 If the first term of an arithmetical progression is 7 the common difference 3 and the number of terms 9 what is the last term

$z = a + (n-1)d = 7 + (9-1)3 =$ Ans 31

$z = 7 + 24 = 31$ last term

---

2 If the last term of an increasing progression is 66 the number of terms 14 and the common difference 5 what is the first term Ans 8

$a = z - (n-1)d = 66 - (14-1)5$

$a = 66 - 58$

$a = 8$ first term

---

3 Find 6 arithmetical means between 1 and 43

$d = \frac{z - a}{m+1} = \frac{43 - 1}{6+1} = 6$ common difference 6

$d = 6$ common difference

Reduce $d = \frac{2s - 2an}{n^2 - n}$ $=$ $dn^2 - dn = 2s - 2an$

$dn^2 - dn + 2an = 2s$

$dn^2 + (2a - d) \times n = 2s$

$d \,|\, dn^2 + (2a - d)n = 2s$

$n^2 + \frac{2a - d}{d}(n) = \frac{2s}{d}$

$n^2 + \frac{2a - d}{d}(n) + \frac{(2a-d)^2}{4d^2} = \frac{(2a-d)^2}{4d^2} + \frac{2s}{d}$

$n + \frac{2a-d}{2d} = \sqrt{\frac{(2a - d)^2 + 8ds}{4d^2}}$ $=$ $\frac{\sqrt{(2a-d)^2 + 8ds}}{2d}$

$n = \sqrt{\text{[illegible]}} - \frac{2a - d}{2d} = \frac{\sqrt{(2a-d)^2 + 8ds} - 2a + d}{2d}$

Ans

Arithmetical Progression

Ex 1 If the first term of an increasing progres is 3 the common difference 2 and the number of terms 20 what is the sum of the series Ans 440

$z = a + (n-1)d = 3 + (20-1)2 = 41$

$S = \frac{a+z}{2} \times n = \frac{3+41}{2} \times 20 = 440$ Ans

---

2 If 100 Stones be placed in a straight line at the distance of a yd from each other how far must a person travel to bring them one by one to a box placed at the distance of a yd from the first stone Ans 5 miles 1300 yds

$z = a + (n-1)d$

$z = 2 + (100-1)2 = 200$ last term

$S = \frac{2+200}{2} \times 100 = 10100$

1760)10100(5m
8800
1300 yds

---

3 What is the sum of 150 terms of the series $\frac{1}{3}\ \frac{2}{3}\ 1\ \frac{4}{3}\ \frac{5}{3}\ 2\ \frac{7}{3}$ &c

$z = a + (n-1)d$

$z = \frac{1}{3} + (150-1)\frac{1}{3} = \frac{150}{3}$

$S = \frac{\frac{1}{3} + \frac{150}{3}}{2} \times 150 = 3775$ Ans

$\frac{151}{6} = 25\frac{1}{6}$
150
1250
4525
3775 Ans

---

4 If the sum of an 1455 the last term 5 and the number of terms 30 what is the common difference Ans 3

$d = \frac{2S - 2an}{n^2 - n}$

$d = \frac{2910 - 300}{900 - 30} = \frac{2610}{870} = 3$ Common Difference

---

5 If the sum of an arithmetical series is 567 the first term 7 and the common difference 2 what is the number of terms Ans 21

$n = \frac{\sqrt{(2a-d)^2 + 8dS} - 2a + d}{2d}$

$n = \frac{\sqrt{144 - 25 + 9072} - 14 + 2}{4}$

12
12
144
9072
9216(96
81
186) 1116
1116

96
−12
$\frac{84}{4} = 21$ number of terms

Aritmetical

6 What is the sum of 32 terms of the series 1 1½ 2 2½ 3 &c

$l = a + (n-1)d$

$l = 1 + (32-1)\frac{1}{2} = \frac{31}{2} + 1 = \frac{33}{2}$

$1 + \frac{33}{2} = \frac{2+33}{4} \times 32 = \frac{1120}{4} = 280$ Ans

7. A gentleman bought 47 books and gave 10 cts for the first 30 for the second 50 for the third &c what did he gave for the whole

$l = a + (n-1)d$

$l = 10 + (47-1)20 = 930$

$S = \frac{a+l}{2} \times n = \frac{10+930}{2} \times 47$

$\frac{940}{2} = 470$

$\times 47$

3290

1880

22090 Ans

8 A person put into a charity box a cent the first day of the year two cents the second day 3 cts the third day &c to the end of the year what was the whole sum for 365 days

$l = a + (n-1)d$

$l = 1 + (365-1)1 = 365$

$\frac{1+365}{2} \times 365$ Ans 66.795 cts

$\frac{366}{2} = 183$

365

915

1098

549

\$ 667.95 Ans

Art 433 Prob 2 The sum of three numbers in arithmetical progression is 9 and the sum of their cubes is 153 what are the numbers

Sup x = second y = common difference

$(x-y) + x + x + y = 9$

$2x + x = 9$

$3)3x = 9$

$x = 3$ second number

$x^3 - 3x^2y + 3xy^2 - y^3 + x^3 + x^3 + 3x^2y + 3xy^2 + y^3 = 153$

$x^3 + x^3 + x^3 + 3xy^2 + 3xy^2 = 153$

$3x^3 + 6xy^2 = 153$

Progression

7 There are 4 numbers in arithmetical progression whose sum is 28 and their continued product 585 what are the numbers

$x-y \quad x \quad x+y \quad x+2y$

$$x-y$$
$$x+y$$
$$2x$$
$$3x$$
$$x+2y$$
$$2)\,4x+2y=28$$
$$2x+y=14$$
$$2)\,2x=14-y$$
$$x=\frac{14-y}{2}$$

$$x+2y$$
$$x+y$$
$$xy+2y^2$$
$$x^2+2xy$$
$$x^2+3xy+2y^2$$
$$x$$
$$x^3+3x^2y+2xy^2$$
$$x-y$$
$$-x^2y-3xy^2-2xy^3$$
$$x^4+3x^3y+2x^2y^2$$
$$x^4+2x^3y-x^2y^2-2xy^3=585$$

$$2x+y$$
$$2x+y$$
$$2xy+y^2$$
$$4x^2+2xy$$
$$4x^2+4xy+y^2$$
$$2x+y$$
$$4x^2y+4xy^2+y^3$$
$$8x^3+8x^2y+2xy^2$$
$$8x^3+12x^2y+6xy^2+y^3$$
$$2x+y$$
$$8x^3y+12x^2y^2+6xy^3+y^4$$
$$16x^4+24x^3y+12x^2y^2+2xy^3$$
$$16)\,16x^4+32x^3y+24x^2y^2+8xy^3+y^4=38416$$
$$x^4+2x^3y+\frac{3x^2y^2}{2}+\frac{xy^3}{2}+\frac{y^4}{16}=2401$$
$$x^4+2x^3y-x^2y^2-2xy^3=585$$
$$\frac{5x^2y^2}{2}+\frac{5xy^3}{2}+\frac{y^4}{16}=1816$$

$14 \times 14 = 196$, $196 \times 14 = 2744$, $2744 \times 14 = 38416$

$$160x^2y^2+160xy^3+4y^4=116224$$
$$\frac{31360y^2-4480y^3+160y^4}{4}+\frac{2240y^3-160y^4}{2}+4y^4=116224$$
$$627200y^2-8960y^3+320y^4+8960y^3-640y^4+32y^4=929792$$
$$320y^4$$
$$352y^4$$
$$-640y^4$$
$$-288y^4$$
$$288)\,-288y^4+627200y^2=929792$$
$$y^4-\frac{19600}{9}y^2=-\frac{29056}{9}$$
$$y^4-\frac{19600}{9}y^2+\frac{38416000}{324}=\frac{38416000}{324}-\frac{929792}{288}=\frac{27955584}{324}$$
$$y^2-\frac{1960}{18}=\sqrt{\frac{27955584}{324}}=\frac{1672}{18}$$
$$y^2=\frac{1960}{18}-\frac{1672}{18}=16$$
$y=4$ common difference.

$x=\frac{14-y}{2}=\frac{14-4}{2}=5$ Second term

1. 5. 9. 13. Ans

Geometrical

1 Find two geometrical means between 4 and 256 Ans. ratio 4

$\left(\frac{b}{a}\right)^{\frac{1}{n-1}} = r = \left(\frac{256}{4}\right)^{\frac{1}{4-1}} = 4$ ratio

Series 4. 16. 64. 256.

2 Find three geometrical means between $\frac{1}{9}$ and 9 Ans $\frac{1}{3}$ 1 3

$\left(\frac{9}{\frac{1}{9}}\right)^{\frac{1}{5-1}}$ $\frac{1}{9} \div 9 = \frac{9}{1} \times \frac{9}{1} = \left(\frac{81}{1}\right)^{\frac{1}{4}} = \frac{3}{1}$

$\frac{1}{9} \times \frac{3}{1} = \frac{3}{9} = \frac{1}{3} \times \frac{3}{1} = 1 \times \frac{3}{1} = 3$ Series $\frac{1}{3}$. 1. 3.

Art. 442 Prob 3 What is the sum of the series 1. 3. 9. 27. &c. to 12 terms

$ar^{n-1} = 1 \times (3)^{11}$

81, 243, 729, 2187, 6561, 19683, 59049, 177147

$3 \times \frac{177147}{2} - 1 = \frac{531440}{2} = 265720$ Ans

4 What is the sum of 10 terms of the series 1. $\frac{2}{3}$ $\frac{4}{9}$ $\frac{8}{27}$ &c

$ar^{n-1} = 1 \times (\frac{2}{3})^{10-1}$

$S = \frac{rl - a}{r - 1} = \frac{\frac{2}{3} \times \frac{512}{19683} - 1}{\frac{2}{3} - 1}$

$\frac{\frac{1024}{59049} - 1}{\frac{1}{3}} = \frac{1024}{59049} - \frac{59049}{59049}$

$\frac{58025}{59049} \div \frac{1}{3}$

$\frac{58025}{59049} \times \frac{3}{1} = \frac{174075}{59049}$ Ans

3, 9, 27, 81, 243, 729, 2187, 6561, 19683

2, 4, 8, 16, 32, 64, 128, 256, 512

Art. 444. 1

Prob 1 Find 3 numbers in geometrical progression such that their sum shall be 14 and the sum of their squares 84

Progression.

$xy = 16$

$y = \frac{16}{x}$

$x + 4 + \frac{16}{x} = 14$

$x^2 + 4x + 16 = 14x$

$x^2 - 10x = -16$

$x^2 - 10x + 25 = 25 - 16 = 9$

$x - 5 = \sqrt{9} = 3$

$x = 5 \pm 3 = 8$

$y = \frac{16}{x} = \frac{16}{8} = 2$

$y = 2$
$x = 8$
$z = 4$ Answer

$xz = y^2$
$x + y + z = 14$
$x^2 + y^2 + z^2 = 84$

$x + y + z = 14$
$x + y + z = 14$
$xy + y^2 + xz + zy + z^2 = 196$

$2\,|\,2xy + 2xz + 2zy = 112$
$xy + xz + zy = 56$
$xy + y^2 + zy = 14y$
$xz - y^2 = 56 - 14y$
$xz = y^2$
$56 - 14y = y^2$
$14\,|\,14y = 56$
$y = 4$

2 There are 3 numbers in geometrical progression whose product is 64 and the sum of their cubes is 584 what are the numbers

x = first term
y = ratio

$x^3 + x^3y^3 + x^3y^6 = 584$
$x^3y^3 = 64$
$x^3 + x^3y^6 = 520$
$x^3y^6 = 64y^3$
$x^3 = 520 - 64y^3$

$520 - 64y^3 \times y^3 = 64$

$520y^3 - 64y^6 = 64$

$64\,|\,64y^6 - 520y^3 = -64$
$y^6 - \frac{130y^3}{16} = -1$

$y^6 - \frac{130y^3}{16} + \frac{16900}{1024} = \frac{16900}{1024} - 1 = \frac{15876}{1024}$

$y^3 - \frac{130}{32} = \sqrt{\frac{15876}{1024}} = \frac{126}{32}$

$y^3 = \frac{130}{32} + \frac{126}{32} = 8$

$y = 2$

$x^3 \times 8 = 64$
$8\,|\,8x^3 = 64$
$x^3 = 8$
$x = 2$

2. 4. 8. Ans.

3 There are three numbers in arithmetical progression the sum of the first and last is 52 and the square of the mean is 100 what are the numbers

$x : y : z$

$xz = y^2 = 100$
$x + z = 52$
$z = 52 - x$

$xz = y^2 = 100$
$100 = xz$
$52 = x + z \times x$
$52x = x^2 + xz$
$100 = xz$
$52x - 100 = x^2$

$x^2 = 52x - 100$
$x^2 - 52x = -100$
$x^2 - 52x + 676 = 676 - 100$
$x - 26 = \sqrt{576} = 24$
$x = 26 \pm 24 = 50$
$x = 50$

$50\,|\,\frac{100 = 50z}{50z = 100}$
$z = 2$

$y^2 = 100$
$y = \sqrt{100} = 10$
$y = 10$

2. 10. 50.
Ans

Geometrical

4 Of 4 numbers in geometrical progression the sum of the 2 first is 15 and the sum of the 2 last is 60 What are the numbers

Series $x \quad xy \quad xy^2 \quad xy^3$

$x+xy = 15 \times y^2$
$xy^2+xy^3 = 60$
$xy^2+xy^3 = 15y^2$
$xy^2+xy^3 = 60$
$60 = 15y^2$

$15 \,|\, 15y^2 = 60$
$y^2 = 4$
$y = 2$

$x+2x = 15$
$3|3x = 15$
$x = 5$

5. 10. 20. 40. Ans

5. A gentleman divided 210 $ among 3 servants in such a manner that their portion were in geometrical progression and the first had 90 $ more than the last how much had each

Let x = 1st
y = ratio

$x + xy + xy^2 = 210$
$x + xy \quad = 90 \times y$
$xy + xy^2 = 90y$
$x + xy + xy^2 = 210$
$x = 210 - 90y$

$210 - 90y + \frac{210 - 90y \times y}{y} = 90$

$210 - 90y + \frac{210y - 90y^2}{90y} = 90$

$90 \,|\, 90y^2 - 120y = 210 - 90 = 120$
$y^2 - \frac{4}{3}y$ $\quad \frac{4}{3}$
$y^2 - \frac{4}{3}y + \frac{16}{36} = \frac{16}{36} + \frac{4}{3} = \frac{64}{36}$
$y - \frac{4}{6} = \sqrt{\frac{64}{36}} = \frac{8}{6}$
$y = \frac{4}{6} + \frac{8}{6} = 2$
$y = 2$

$x + 2x = 90$
$3 \,|\, 3x = 90$
$x = 30$

Ans 30. 60. 120.

6 There are 3 numbers in arithmetical progression the greatest of which exceed the least by 15 and the difference of the squares of the greatest and least is to the sum of the squares of all three numbers as 5 to 7 what are the numbers.

Sup x = first number
y = ratio

$x. \quad xy^2. \quad xy^3$
$x - xy = 15$

$x^2 \,|\, x^2y^4 - x^2 : x^2 + x^2y^2 + x^2y^4 :: 5 : 7$
$y^4 - 1 : 1 + y^2 + y^4 :: 5 : 7$
$y^4 - 1 : 2y^4 + y^2 :: 5 : 12$
$12y^4 - 12 = 10y^4 + 5y^2$

Progression

$x + x \times 2 = 15$

$x + 2x = 15$

$3\,|\,3x = 15$

$x = 5$ 1st term

5. 10. 20.

Ans

$12z^4 - 12 = 10z^4 + 3z^2$

$12z^4$

$-10z^4 - 5z^2 = 12$

$2\,|\,2z^4 - 5z^2 = 12$

$z^4 - \frac{5}{2}z^2 = 6$

$z^4 - \frac{5}{2}z^2 + \frac{25}{16} = \frac{25}{16} + 6 = \frac{121}{16}$

$z^2 - \frac{5}{4} = \sqrt{\frac{121}{16}} = \frac{11}{4}$

$z^2 = \frac{5}{4} + \frac{11}{4} = 4$

ratio $z = 2$

---

7 There are 4 numbers in geometrical progression the second of which is less than the fourth by 24 and the sum of the extremes is to the sum of the means as 7 to 3 what are the numbers. Ans 1. 3. 9. 27.

Supp x = first term $x.\ xz.\ xz^2.\ xz^3.$

z = ratio

$x\,|\,x + xz^3 : xz + xz^2 :: 7 : 3$ second equation

$1 + z^3 : z + z^2 :: 7 : 3$

$z+1\,|\,z^3 + z^2 + z + 1 : z + z^2 :: 10 : 3$

$z^2 + 1 : z :: 10 : 3$

$xz^3 - xz = 24$ first equation

$3z^2 + 3 = 10z$

$3\,|\,3z^2 - 10z = -3$

$z^2 - \frac{10}{3}z = -1$

$z^2 - \frac{10}{3}z + \frac{100}{36} = \frac{100}{36} - 1 = \frac{64}{36}$

$z - \frac{10}{6} = \sqrt{\frac{64}{36}} = \frac{8}{6}$

$z = \frac{10}{6} + \frac{8}{6} = 3$ Ratio

$x \times 27 - x \times 3 = 24$

$27x - 3x = 24$

$24\,|\,24x = 24$

$x = 1$ First term

1. 3. 9. 27 Answer

Involution of Binomials

3 Expand $\sqrt{2}$ or $(1+1)^{\frac{1}{2}}$

$(1+1)^{\frac{1}{2}} = 1^{\frac{1}{2}} + 1^{-\frac{1}{2}}1 + 1^{-\frac{3}{2}}1^2 + 1^{-\frac{5}{2}}1^3 + 1^{-\frac{7}{2}}1^4 + 1^{-\frac{9}{2}}1^5$

$\frac{1}{2} \times \frac{-\frac{1}{2}}{2} = \frac{1}{2} \times -\frac{1}{4} = \frac{-1}{2.4}$ coefficient of the third term

$\frac{-1}{2.4} \times \frac{-\frac{3}{2}}{3} = \frac{-1}{2.4} \times \frac{-3}{6} = \frac{3}{2.4.6}$ 4th

$\frac{3}{2.4.6} \times \frac{-\frac{5}{2}}{4} = \frac{3}{2.4.6} \times \frac{-5}{8} = \frac{-3.5}{2.4.6.8}$

$\frac{-3.5}{2.4.6.8} \times \frac{-\frac{7}{2}}{5} = \frac{-3.5}{2.4.6.8} \times \frac{-7}{10} = \frac{3.5.7}{2.4.6.8.10}$

$(1+1)^{\frac{1}{2}} = 1 + \frac{1}{2} - \frac{1}{2.4} + \frac{3}{2.4.6} - \frac{3.5}{2.4.6.8} + \frac{3.5.7}{2.4.6.8.10}$

4 Expand $(a+x)^{\frac{1}{2}}$ or $a^{\frac{1}{2}} \times (1+\frac{x}{a})^{\frac{1}{2}}$

$(a+x)^{\frac{1}{2}} = a^{\frac{1}{2}} \times (1+\frac{x}{a})^{\frac{1}{2}} = 1^{\frac{1}{2}} + 1^{-\frac{1}{2}}\frac{x}{a} + 1^{-\frac{3}{2}}\frac{x^2}{a^2} + 1^{-\frac{5}{2}}\frac{x^3}{a^3} + 1^{-\frac{7}{2}}\frac{x^4}{a^4}$

$\frac{1}{2} \times \frac{-\frac{1}{2}}{2} = \frac{1}{2} \times -\frac{1}{4} = \frac{-1}{2.4}$

$\frac{-1}{2.4} \times \frac{-\frac{3}{2}}{3} = \frac{-1}{2.4} \times \frac{-3}{6} = \frac{3}{2.4.6}$ coefficients

$\frac{3}{2.4.6} \times \frac{-\frac{5}{2}}{4} = \frac{3}{2.4.6} \times \frac{-5}{8} = \frac{-3.5}{2.4.6.8}$

$a^{\frac{1}{2}} \times (1+\frac{x}{a})^{\frac{1}{2}} = a^{\frac{1}{2}} \times (1 + \frac{x}{2a} - \frac{x^2}{2.4a^2} + \frac{3x^3}{2.4.6a^3} - \frac{3.5x^4}{2.4.6.8a^4}$ Ans

5 Expand $(a+b)^{\frac{1}{3}}$ or $a^{\frac{1}{3}} \times (1+\frac{b}{a})^{\frac{1}{3}}$

~~[illegible]~~ $a^{\frac{1}{3}} \times (1+\frac{b}{a})^{\frac{1}{3}} = 1^{\frac{1}{3}} + 1^{-\frac{2}{3}}\frac{b}{a} + 1^{-\frac{5}{3}}\frac{b^2}{a^2} \times 1^{-\frac{8}{3}}\frac{b^3}{a^3} + 1^{-\frac{11}{3}}\frac{b^4}{a^4}$

$\frac{1}{3} \times \frac{-\frac{2}{3}}{2} = \frac{1}{3} \times -\frac{2}{6} = \frac{-2}{3.6}$

$\frac{-2}{3.6} \times \frac{-\frac{5}{3}}{3} = \frac{-2}{3.6} \times \frac{-5}{9} = \frac{2.5}{3.6.9}$

$\frac{2.5}{3.6.9} \times \frac{-\frac{8}{3}}{4} = \frac{2.5}{3.6.9} \times \frac{-8}{12} = \frac{-2.5.8}{3.6.9.12}$

$a^{\frac{1}{3}} \times (1+\frac{b}{a})^{\frac{1}{3}} = a^{\frac{1}{3}} \times (1 + \frac{b}{3a} - \frac{2b^2}{3.6a^2} + \frac{2.5b^3}{3.6.9a^3} - \frac{2.5.8b^4}{3.6.9.12a^4}$ Ans

6 Expand into a series $(a-b)^{\frac{1}{4}}$

$(a-b)^{\frac{1}{4}} = a^{\frac{1}{4}} \times (1-\frac{b}{a})^{\frac{1}{4}} = 1^{\frac{1}{4}} - 1^{-\frac{3}{4}}\frac{b}{a} + 1^{-\frac{7}{4}}\frac{b^2}{a^2} - 1^{-\frac{11}{4}}\frac{b^3}{a^3} + 1^{-\frac{15}{4}}\frac{b^4}{a^4}$

$\frac{1}{4} \times \frac{-\frac{3}{4}}{2} = \frac{1}{4} \times \frac{-3}{8} = \frac{-3}{4.8}$

$\frac{-3}{4.8} \times \frac{-\frac{7}{4}}{3} = \frac{-3}{4.8} \times \frac{-7}{12} = \frac{3.7}{4.8.12}$

$\frac{3.7}{4.8.12} \times \frac{-\frac{11}{4}}{4} = \frac{3.7}{4.8.12} \times \frac{-11}{16} = \frac{-3.7.11}{4.8.12.16}$

$a^{\frac{1}{4}} \times (1-\frac{b}{a})^{\frac{1}{4}} = a^{\frac{1}{4}}(1 - \frac{b}{4} - \frac{3b^2}{4.8a^2} - \frac{3.7b^3}{4.8.12a^3} - \frac{3.7.11b^4}{4.8.12.16a^4}$

Involution of

6 Expand into a series $(a+y)^{-4}$

$(a+y)^{-4} = a^{-4} + a^{-5}y + a^{-6}y^2 + a^{-7}y^3 + a^{-8}y^4$

$\frac{-4\times-5}{2} = 10$

$\frac{10\times-6}{3} = -20$

$\frac{-20\times-7}{4} = 35$

$(a+y)^{-4} = \frac{1}{a^4} - \frac{4y}{a^5} + \frac{10y^2}{a^6} - \frac{20y^3}{a^7} + \frac{35y^4}{a^8}$ Ans

7 Expand into a series $(c^3+x^3)^{\frac{1}{3}}$

substituting $a+y$ for c^3+x^3

$a\times(1+\frac{y}{a})^{\frac{1}{3}} = 1^{\frac{1}{3}} + 1^{-\frac{2}{3}}\frac{y}{a} + 1^{-\frac{5}{3}}\frac{y^2}{a^2} + 1^{-\frac{8}{3}}\frac{y^3}{a^3}$

$\frac{1}{3}\times\frac{-2}{2} = \frac{1}{3}\times\frac{-2}{6} = -\frac{2}{3.6}$

$-\frac{2}{3.6}\times\frac{-5}{3} = -\frac{2}{3.6}\times\frac{-5}{9} = \frac{2.5}{3.6.9}$

$(c^3+x^3)^{\frac{1}{3}} = (c^3)^{\frac{1}{3}}\times(1+\frac{x^3}{c^3})^{\frac{1}{3}} = c\times(1+\frac{x^3}{3c^3} - \frac{2x^6}{3.6c^6} + \frac{2.5x^9}{3.6.9c^9}$ Ans

8 Expand $\frac{d}{\sqrt{c^2+x^2}}$ or $d(c^2+x^2)^{-\frac{1}{2}}$

$d(c^2+x^2)^{-\frac{1}{2}} = d\times(c^2)^{-\frac{1}{2}}(1+\frac{x^2}{c^2})^{-\frac{1}{2}} = 1^{-\frac{1}{2}} + 1^{-\frac{3}{2}}\frac{x^2}{c^2} + 1^{-\frac{5}{2}}\frac{x^4}{c^4} + 1^{-\frac{7}{2}}\frac{x^6}{c^6} + 1^{-\frac{9}{2}}\frac{x^8}{c^8}$

$d\times(c^2)^{-\frac{1}{2}} = \frac{d}{c}$

$-\frac{1}{2}\times\frac{-3}{2} = -\frac{1}{2}\times\frac{-3}{4} = \frac{3}{2.4}$

$\frac{3}{2.4}\times\frac{-5}{3} = \frac{3}{2.4}\times\frac{-5}{6} = -\frac{3.5}{2.4.6}$

$-\frac{3.5}{2.4.6}\times\frac{-7}{4} = -\frac{3.5}{2.4.6}\times\frac{-7}{8} = \frac{3.5.7}{2.4.6.8}$

$\frac{d}{c}(1 - \frac{x^2}{2c^2} + \frac{3x^4}{2.4c^4} - \frac{3.5x^6}{2.4.6c^6} + \frac{3.5.7x^8}{2.4.6.8c^8}$ Ans

9 Find the 5th power (a^2+y^3)

$(b+x)^5 = b^5 + b^4x + b^3x^2 + b^2x^3 + bx^4 + x^5$ Substituting $b+x$ for a^2+y^3

$\frac{5\times4}{2} = 10$ $\quad (b+x)^5 = b^5 + 5b^4x + 10b^3x^2 + 10b^2x^3 + 5bx^4 + x^5$

$\frac{10\times3}{3} = 10$

$\frac{10\times2}{4} = 5$ $\quad (a^2+y^3)^5 = a^{10} + 5a^8y^3 + 10a^6y^6 + 10a^4y^9 + 5a^2y^{12} + y^{15}$ Ans

restoring a^2+y^3

10 Find the 4th power of $(a+b+x)$

Substituting h for $b+x$ $\qquad \frac{4\times3}{2} = 6$

$(a+h)^4 = a^4 + a^3h + a^2h^2 + ah^3 + h^4$ $\qquad \frac{6\times2}{3} = 4$

$(a+h)^4 = a^4 + 4a^3h + 6a^2h^2 + 4ah^3 + h^4$

$(a+b+x)^4 = a^4 + 4a^3\times(b+x) + 6a^2\times(b+x)^2 + 4a\times(b+x)^3 + (b+x)^4$

Restoring $b+x$ $\qquad$ Ans

Binomials By ...

11 Expand $(a^3-x)^{\frac{1}{2}}$

$(a^3-x)^{\frac{1}{2}} = a^3 \times (1-\frac{x}{a^3})^{\frac{1}{2}} = 1^{\frac{1}{2}} - 1^{-\frac{1}{2}}\frac{x}{a^3} + 1^{-\frac{3}{2}}\frac{x^2}{a^6} - 1^{-\frac{5}{2}}\frac{x^3}{a^9}$ &c

$a^3(1-\frac{x}{a^3})^{\frac{1}{2}} = a^{\frac{3}{2}} \times (1 - \frac{x}{2a^3} - \frac{x^2}{2.4a^6} - \frac{3x^3}{2.4.6a^9}$ &c

$\frac{1}{2} \times -\frac{1}{2} = \frac{1}{2} \times -\frac{1}{4} = \frac{1}{2.4}$

12 Expand $(1-y^2)^{\frac{1}{2}}$ $(1-y^2)^{\frac{1}{2}} = 1^{\frac{1}{2}} - 1^{-\frac{1}{2}}y^2 + 1^{-\frac{3}{2}}y^4 - 1^{-\frac{5}{2}}y^6$ &c

$\frac{1}{2} \times \frac{-1}{2} = \frac{1}{2} \times -\frac{1}{4} = \frac{-1}{2.4}$

$-\frac{1}{2.4} \times -\frac{3}{2} = \frac{-1}{2.4} \times -\frac{3}{6} = \frac{3}{2.4.6}$

$(1-y^2)^{\frac{1}{2}} = 1 - \frac{y^2}{2} - \frac{y^4}{2.4} - \frac{3y^6}{2.4.6}$ (Ans

13 Expand $(a-x)^{\frac{1}{3}}$

$(a-x)^{\frac{1}{3}} = a^{\frac{1}{3}} \times (1-\frac{x}{a})^{\frac{1}{3}} = 1^{\frac{1}{3}} - 1^{-\frac{2}{3}}\frac{x}{a} + 1^{-\frac{5}{3}}\frac{x^2}{a^2} - 1^{-\frac{8}{3}}\frac{x^3}{a^3}$ &c

$\frac{1}{3} \times -\frac{2}{3} = \frac{1}{3} \times -\frac{2}{6} = \frac{-2}{3.6}$

$\frac{-2}{3.6} \times -\frac{5}{3} = \frac{-2}{3.6} \times -\frac{5}{9} = \frac{2.5}{3.6.9}$

(Ans

$a^{\frac{1}{3}} \times (1-\frac{x}{a})^{\frac{1}{3}} = a^{\frac{1}{3}}(1 - \frac{x}{3a} - \frac{2x^2}{3.6a^2} - \frac{2.5x^3}{3.6.9a^3})$ &c

14 Expand $h(a^3-y^3)^{\frac{1}{3}}$ $h(a^3-y^3)^{\frac{1}{3}} = h \times (a^3)^{\frac{1}{3}}(1-\frac{y^3}{a^3})^{\frac{1}{3}}$

$h(a^3)^{\frac{1}{3}} \times (1-\frac{y^3}{a^3})^{\frac{1}{3}} = 1^{\frac{1}{3}} - 1^{-\frac{2}{3}}\frac{y^3}{a^3} + 1^{-\frac{5}{3}}\frac{y^6}{a^6} - 1^{-\frac{8}{3}}\frac{y^9}{a^9}$ &c

$\frac{1}{3} \times -\frac{2}{3} = \frac{1}{3} \times -\frac{2}{6} = -\frac{2}{3.6}$

$-\frac{2}{3.6} \times -\frac{5}{3} = \frac{-2}{3.6} \times -\frac{5}{9} = \frac{2.5}{3.6.9}$ $(h \times (a^3)^{\frac{1}{3}} = ha$

$h \times (a^3)^{\frac{1}{3}} \times (1-\frac{y^3}{a^3})^{\frac{1}{3}} = ah \times (1 - \frac{y^3}{3a^3} - \frac{2y^6}{3.6a^6} - \frac{2.5y^9}{3.6.9a^9}$ &c

(Ans

Surds

Roots of Binomials

3 Find the square root of $6-2\sqrt{5}$ Ans $\sqrt{5}-1$

$$\sqrt{a+\sqrt{b}} = \sqrt{\frac{a+\sqrt{a^2-b}}{2}} + \sqrt{\frac{a-\sqrt{a^2-b}}{2}}$$

$$\sqrt{a-\sqrt{b}} = \sqrt{\frac{a+\sqrt{a^2-b}}{2}} - \sqrt{\frac{a-\sqrt{a^2-b}}{2}}$$

$$\sqrt{6-2\sqrt{5}} = \sqrt{\frac{6+\sqrt{36-20}}{2}} - \sqrt{\frac{6-\sqrt{36-20}}{2}}$$

$$\sqrt{6+2\sqrt{5}} = \sqrt{\frac{6+4}{2}} - \sqrt{\frac{6-4}{2}} =$$

$$\sqrt{6+2\sqrt{5}} = \sqrt{5} - 1 \text{ Ans}$$

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4 Find the square root of $7+4\sqrt{3}$ Ans $2+\sqrt{3}$

$$\sqrt{a+\sqrt{b}} = \sqrt{\frac{a+\sqrt{a^2-b}}{2}} + \sqrt{\frac{a-\sqrt{a^2-b}}{2}}$$

$$\sqrt{a-\sqrt{b}} = \sqrt{\frac{a+\sqrt{a^2-b}}{2}} - \sqrt{\frac{a-\sqrt{a^2-b}}{2}}$$

$$\sqrt{7+4\sqrt{3}} = \sqrt{\frac{7+\sqrt{49-48}}{2}} + \sqrt{\frac{7-\sqrt{49-48}}{2}}$$

$$\sqrt{7+4\sqrt{3}} = \sqrt{\frac{7+1}{2}} + \sqrt{\frac{7-1}{2}}$$

$$\sqrt{7+4\sqrt{3}} = 2 + \sqrt{3} \text{ Ans}$$

5 Find the square root of $7-2\sqrt{10}$ Ans $\sqrt{5}-\sqrt{2}$

$$\sqrt{a+\sqrt{b}} = x+\sqrt{y}$$
$$\sqrt{a-\sqrt{b}} = x-\sqrt{y}$$
$$a+\sqrt{b} = x^2+2x\sqrt{y}+y$$
$$a-\sqrt{b} = x^2-2x\sqrt{y}+y$$
$$2a = 2x^2 + 2y$$
$$a = x^2 + y$$
$$\sqrt{a^2-b} = x^2 - y$$
$$a+\sqrt{a^2-b} = 2x^2 = x = \sqrt{\frac{a+\sqrt{a^2-b}}{2}}$$
$$a-\sqrt{a^2-b} = 2y = \sqrt{y} = \sqrt{\frac{a-\sqrt{a^2-b}}{2}}$$

$$\sqrt{a+\sqrt{b}} = x+\sqrt{y}$$
$$\sqrt{a-\sqrt{b}} = x-\sqrt{y}$$
$$\sqrt{a^2-b} = x^2-y$$

$$\sqrt{a+\sqrt{b}} = \sqrt{\frac{a+\sqrt{a^2-b}}{2}} + \sqrt{\frac{a-\sqrt{a^2-b}}{2}}$$

$$\sqrt{a-\sqrt{b}} = \sqrt{\frac{a+\sqrt{a^2-b}}{2}} - \sqrt{\frac{a-\sqrt{a^2-b}}{2}}$$

$$\sqrt{7-2\sqrt{10}} = \sqrt{\frac{7+\sqrt{49-40}}{2}} - \sqrt{\frac{7-\sqrt{49-40}}{2}}$$

$$\sqrt{7-2\sqrt{10}} = \sqrt{\frac{7+3}{2}} - \sqrt{\frac{7-3}{2}}$$

$$\sqrt{7-2\sqrt{10}} = \sqrt{5} - \sqrt{2} \text{ Ans}$$

Infinite Series

Art. 489. 4 $\sqrt{1+x}$ $\left(1+\frac{x}{2}-\frac{x^2}{8}+\frac{x^3}{16}-\frac{5x^4}{128}\right.$

$2+\frac{x}{2}) \; x$

$x+\frac{x^2}{4}$

$2+x-\frac{x^2}{8}) -\frac{x^2}{4}$

$-\frac{x^2}{4}-\frac{x^3}{8}+\frac{x^4}{64}$

$2+x-\frac{x^2}{4}+\frac{x^3}{16}) \; \frac{x^3}{8}-\frac{x^4}{64}$

$\frac{x^3}{8}+\frac{x^4}{16}-\frac{x^5}{64}+\frac{x^6}{256}$

$2+x-\frac{x^2}{4}+\frac{x^3}{8}-\frac{5x^4}{128}) \; \frac{5x^4}{64}+\frac{x^5}{64}-\frac{x^6}{256}$

$\frac{5x^4}{64}$ &c

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5 Expand into a series $\frac{1+2x}{1-x-x^2}$

Assume $\frac{1+2x}{1-x-x^2} = A+Bx+Cx^2+Dx^3$ &c

$-Ax-Bx^2-Cx^3-Dx^4$ &c

$-1-2x-Ax^2-Bx^3-Cx^4-Dx^5$ &c

$0 = A-1)Bx-Ax-2x)Cx^2-Bx^2-Ax^2)Dx^3-Cx^3-Bx^3)$ &c

$A-1=0$

$A=1$

$x | Bx-Ax-2x=0$

$B-A-2=0$

$B=A+2$

$x^2 | Cx^2-Bx^2-Ax^2=0$

$C-B-A=0$

$C=B+A$

$x^3 | Dx^3-Cx^3-Bx^3=0$

$D-C-B=0$

$D=C+B$

$\frac{1+2x}{1-x-x^2} = 1+3x+4x^2+7x^3$ &c

Ans

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4 Expand into a series $\frac{d}{c-ax}$

$\frac{d}{c-ax} = \frac{d}{c}\left(\frac{1}{1-\frac{ax}{c}}\right) = A+Bx+Cx^2+Dx^3+Ex^4$ &c

$A+Bx+Cx^2+Dx^3+Ex^4$ &c

$-1-\frac{Aax}{c}-\frac{Bax^2}{c}-\frac{Cax^3}{c}-\frac{Dax^4}{c}-\frac{Eax^5}{c}$ &c

$0 = A-1)(Bx-\frac{Aax}{c})(Cx^2-\frac{Bax^2}{c})(Dx^3-\frac{Cax^3}{c})(Ex^4-\frac{Dax^4}{c}$

$A-1=0$

$A=1$

$x | Bx-\frac{Aax}{c}=0$

$B-\frac{Aa}{c}=0$

$B=\frac{a}{c}A$

$x^2 | Cx^2-\frac{Bax^2}{c}=0$

$C-\frac{Ba}{c}=0$

$C=\frac{a}{c}B$

$x^3 | Dx^3-\frac{Cax^3}{c}=0$

$D-\frac{Ca}{c}=0$

$D=\frac{a}{c}C$

$\frac{d}{c}\left(\frac{1}{1-\frac{ax}{c}}\right) = \frac{d}{c}\left(1+\frac{a}{c}x+\frac{a^2}{c^2}x^2+\frac{a^3}{c^3}x^3\right.$ &c

Answer

5 | 120/4 | 6 | 1-a/9 | 7 | 8 | 4/5

9 | 6 | 10 | 4/5 | 2/5 | 11 | 9 | 1 | 2 | 7 ans

13 | 4 | 14 | 9 | 15 | 7 | 16 | 1 ans.

17 | 4 ans | 18 | 7 ans | 19 | 4

20 | 2 ans

Infinite Series

5 Expand into a series $\frac{1-x}{1-2x-3x^2}$

$\frac{1-x}{1-2x-3x^2} = A + Bx + Cx^2 + Dx^3 + Ex^4$ &c.

$A + Bx + Cx^2 + Dx^3 + Ex^4$ &c
$-2Ax - 2Bx^2 - 2Cx^3 - 2Dx^4 - 2Ex^5$ &c
$-1 \quad +x - 3Ax^2 - 3Bx^3 - 3Cx^4 - 3Dx^5 - 3Ex^6$

$0 = A-1)(Bx - 2Ax + x)(Cx^2 - 2Bx^2 - 3Ax^2)(Dx^3 - 2Cx^3 - 3Bx^3)(Ex^4$ ...

$A - 1 = 0$ | $x)\ Bx - 2Ax + x = 0$ | $x^2)\ Cx^2 - 2Bx^2 - 3Ax^2 = 0$ | $x^3)\ Dx^3 - 2Cx^3 - 3Bx^3 = 0$
$A = 1$ | $B - 2A + 1 = 0$ | $C - 2B - 3A = 0$ | $D - 2C - 3B = 0$
 | $B = 2A - 1$ | $C = 2B + 3A$ | $D = 2C + 3B$

$\frac{1-x}{1-2x-3x^2} = 1 + x + 5x^2 + 13x^3 + 41x^4$ &c

$x^4)\ Ex^4 - 2Dx^4 - 3Cx^4 = 0$
$E - 2D - 3C = 0$
$E = 2D + 3C$

6 Expand into a series $\frac{1}{1-x-x^2+x^3}$

Assume $\frac{1}{1-x-x^2+x^3} = A + Bx + Cx^2 + Dx^3 + Ex^4$ &c
$-Ax - Bx^2 - Cx^3 - Dx^4$ &c.
$-1 \quad -Ax^2 - Bx^3 - Cx^4$ &c
$Ax^3 + Bx^4$ &c

$0 = (A-1)(Bx - Ax)(Cx^2 - Bx^2 - Ax^2)(Dx^3 - Cx^3 - Bx^3 + Ax^3)(Ex^4 - Dx^4 - Cx^4 + Bx^4$

$A - 1 = 0$ | $x)\ Bx - Ax = 0$ | $x^2)\ Cx^2 - Bx^2 - Ax^2 = 0$ | $x^3)\ Dx^3 - Cx^3 - Bx^3 + Ax^3 = 0$
$A = 1$ | $B - A = 0$ | $C - B - A = 0$ | $D - C - B + A = 0$
 | $B = A$ | $C - B - A$ | $D = C + B - A$

$\frac{1}{1-x-x^2+x^3} = 1 + x + 2x^2 + 2x^3 + 3x^4$ &c
Ans

$x^4)\ Ex^4 - Dx^4 - Cx^4 + Bx^4 = 0$
$E - D - C + B = 0$
$E = D + C - B$

7 Expand into a Series $\frac{a}{1-bx}$

$\frac{a}{1-bx} = A + Bx + Cx^2 + Dx^3 + Ex^4$ &c.
$-a - Abx - Bbx^2 - Cbx^3 - Dx^4$ &c

$0 = A - a) + (Bx - Abx) + (Cx^2 - Bbx^2)(Dx^3 - Cbx^3) + (Ex^4 - Dbx^4)$

$A - a = 0$ | $x)\ Bx - Abx = 0$ | $x^2)\ Cx^2 - Bbx^2 = 0$ | $x^3)\ Dx^3 - Cbx^3 = 0$
$A = a$ | $B - Ab = 0$ | $C - Bb = 0$ | $D - Cb = 0$
 | $B = Ab$ | $C = Bb$ | $D = Cb$

$x^4)\ Ex^4 - Dbx^4 = 0$
$E - Db = 0$
$E = Db$

$\frac{a}{1-bx} = a + abx + ab^2x^2 + ab^3x^3 + ab^4x^4$ &c
Ans

Infinite Series

8 Expand $\frac{1-x}{1-5x+6x^2}$

$$\frac{1-x}{1-5x+6x^2} = A + Bx + Cx^2 + Dx^3 + Ex^4 \ \&c$$
$$-1 \quad -5Ax - 5Bx^2 - 5Cx^3 - 5Dx^4 \ \&c$$
$$x + 6Ax^2 + 6Bx^3 + 6Cx^4 \ \&c$$

$$0 = (A-1) + (Bx - 5Ax + x) + (Cx^2 - 5Bx^3 + 6Bx^2 \ \&c$$

$A - 1 = 0$
$A = 1$

$x) Bx - 5Ax + x = 0$
$B - 5A + 1 = 0$
$B = 5A - 1$

$x^2) Cx^2 - 5Bx^3 + 6Ax^2 = 0$
$C - 5B + 6A = 0$
$C = 5B - 6A$

$$\frac{1-x}{1-5x+6x^2} = 1 + 4 + 14 \ \&c \ \text{Ans}$$

9. Expand $\frac{a+bx}{(1-dx)^2}$

$$\frac{a+bx}{(1-dx)^2} = A + Bx + Cx^2 + Dx^3 \ \&c$$
$$-2Ada - 2Bda^2 - 2Cda^3 \ \&c$$
$$- a - bx + Ad^2x^2 + Bd^2x^3 \ \&c$$

$1 - dx$
$-dx + d^2x^2$
$1 - dx$
$1 - 2dx + d^2x^2$

$$0 = A - a + (Bx - 2Adx - bx) + (Cx^2 - 2Bda^2 + Ad^2x^2 \ \&c$$

$A - a = 0$
$A = a$

$x) Bx - 2Adx - bx = 0$
$B - 2Ad - b = 0$
$B = 2Ad + b$

$x^2) Cx^2 - 2Bda^2 + Ad^2x^2 = 0$
$C - 2Bd + Ad^2 = 0$
$C = 2Bd - Ad^2$

$$\frac{a+bx}{(1-dx)^2} = a + (2ad+b)x + (4ad + 2bd - ad^2)x^2 \ \&c \ \text{Ans}$$

10 Expand $\frac{1+x}{(1-x)^3}$

$$\frac{1+x}{(1-x)^3} = A + Bx + Cx^2 + Dx^3 \ \&c$$
$$-3Ax - 3Bx^2 - 3Cx^3 \ \&c$$
$$3Ax^2 + 3Bx^3 \ \&c$$
$$-1 - x \qquad - Ax^3$$

$1 - x$
$-x + x^2$
$1 - x$
$1 - 2x + x^2$
$1 - x$
$-x + 2x^2 - x^3$
$1 - 2x + x^2$
$1 - 3x + 3x^2 - x^3$

$$0 = A - 1 + (Bx - 3Ax - x) + (Cx^2 - 3Bx^2 + 3Ax^2) + (Dx^3 - 3Cx^3 + 3Bx^3 - Ax^3$$

$A - 1 = 0$
$A = 1$

$x) Bx - 3Ax - x = 0$
$B - 3A - 1 = 0$
$B = 3A + 1$

$x^2) Cx^2 - 3Bx^2 + 3Ax^2 = 0$
$C - 3B + 3A = 0$
$C = 3B - 3A$

$x^3) Dx^3 - 3Cx^3 + 3Bx^3 - Ax^3 = 0$
$D - 3C + 3B - A = 0$
$D = 3C - 3B + A$

$$\frac{1+x}{(1-x)^3} = 1 + 4x + 9x^2 + 16x^3 \ \&c$$

Ans

Infinite Series

3 What is the sum of the infinite series $1+\frac{1}{3}+\frac{1}{9}+\frac{1}{27}+\frac{1}{81}$ &c

$S=\frac{1\cdot 3}{1\cdot 1}=\frac{3\times 1}{2}=\frac{3}{2}$ Ans

Art. 493, 4. What is the sum of the ifinite ser

$\frac{1}{1.2.3}+\frac{1}{2.3.4}+\frac{1}{3.4.5}+\frac{1}{4.5.6}$ &c

$S=\frac{1}{2}+\frac{1}{6}+\frac{1}{12}+\frac{1}{20}$ &c

$S-\frac{1}{2}=\frac{1}{6}+\frac{1}{12}+\frac{1}{20}+\frac{1}{36}$ &c

$\frac{1}{2}=\frac{2}{1.2.3}+\frac{2}{2.3.4}+\frac{2}{3.4.5}+\frac{2}{4.5.6}$ &c by subtraction.

or $\frac{1}{4}=\frac{1}{1.2.3}+\frac{1}{2.3.4}+\frac{1}{3.4.5}+\frac{1}{4.5.6}$ &c

Ans

2 What is the sum of the infinite series

$1+3x+4x^2+7x^3+11x^4+18x^5+29x^6$ &c

Let $S=A+B+C+D+E$ & Sup $m+n$ the relation

$C=Bmx+Anx^2$

$D=Cmx+Bnx^2$

$E=Dmx+Cnx^2$

$S=A+B+(Bmx+Anx^2)+(Cmx+Bnx^2)+Dmx+Cnx^2$

$S=A+B+C$ &c

$S-A=B+C+D$ &c

$S=A+B+(Smx-Amx)+Snx^2$

$1-mx-nx^2)\ S-Smx-Snx^2=A+B-Amx$

$S=\frac{A+B-Amx}{1-mx-nx^2}$

$S=\frac{1+3x-x}{1-x-x^2}=\frac{1+2x}{1-x-x^2}$ Ans

3 What is the sum of the infinite series

$1+x+5x^2+13x^3+41x^4+121x^5+365x^6$ &c?

Let $S=A+B+C+D$ &c

$C=Bmx+Anx^2$

$D=Cmx+Bnx^2$

$S=A+B$ &c

$S-A=B+C$ &c

$S=A+B+(Smx-Amx)+Snx^2$

$1-mx-nx^2)\ S-Smx-Snx=A+B-Amx$

$S=\frac{A+B-Amx}{1-mx-nx^2}$

Infinite Series

$C = Bm + An \times B = BC = BBm + ABn$
$D = Cm + Bn \times A = AD = ACm + ABn$
$BC - AD = BBm - ACm$

$-AC + BB \quad BBm - ACm = BC - AD$

$$m = \frac{BC - AD}{BB - AC}$$

$$m = \frac{5 - 13}{1 - 5} = \frac{-8}{-4} = 2$$

$C = Bmx + Anx^2 \times C$
$D = Cmx + Bnx^2 \times B$

$CC = BCmx + ACnx^2$
$BD = BCmx + BBnx^2$

$CC - BD = ACnx^2 - BBnx^2$

$AC - BB \quad ACnx^2 - BBnx^2 = CC - DB$

$$n = \frac{CC - DB}{AC - BB}$$

$$n = \frac{25 - 1 \times 13}{5 - 1} = \frac{12}{4} = 3$$

$$S = \frac{1 - x}{1 - 2x - 3x^2}$$

Ans

---

4 What is the sum of the infinite series $1 + 2x + 3x^2 + 4x^3 + 5x^4$ &c

Let $S = A + B + C + D$ &c Sup. $m + n$ the relation

$C = Bmx + Anx^2$
$D = Cmx + Bnx^2$.

$S = A + B + (Bmx + Anx^2) + (Cmx + Bnx^2)$
$S = A + B$ &c
$S - A = B + C$ &c

$S = A + B + (Smx - Amx) + (Snx^2$

$1 - mx - nx^2 \quad S - Smx - Snx^2 = A + B - Amx$

$$S = \frac{A + B - Amx}{1 - mx - nx^2}$$

$$m = \frac{DC - BE}{CC - BD} = \frac{4 \times 3 - 2.5}{9 - 2 \times 4} = \frac{2}{1} = 2$$

$$n = \frac{CE - DD}{CC - BD} = \frac{3 \times 5 - 16}{9 - 2 \times 4} = \frac{-1}{1} = 1$$

$$S = \frac{1 + 2x - 2x}{1 - 2x + x^2} = \frac{1}{(1 - x)^2}$$ Ans

Of Infinite Series

5 What is the sum of the infinite series
$1 + 3x + 5x^2 + 7x^3 + 9x^4 + 11x^5$ &c

Let $S = A + B + C + D$ &c sup m + n the relation
$C = Bmx + Anx^2$
$D = Cmx + Bnx^2$

$S = A + B + (Bmx + Anx^2) + (Cmx + Bnx^2)$
$S = A + B$ &c
$S - A = B + C$ &c

$S = A + B + (Smx - Amx) + (Snx^2)$

$1 - mx - nx^2 \mid S - Smx - Snx^2 = A + B - Amx$

$$S = \frac{A + B - Amx}{1 - mx - nx^2}$$

$$m = \frac{DC - BE}{CC - BD} = \frac{7 \times 5 - 3 \times 9}{25 - 3 \times 7} = \frac{8}{4} = 2$$

$$n = \frac{CE - DD}{CC - BD} \quad \frac{5 \times 9 - 49}{25 - 3 \times 7} = \frac{-4}{4} = -1$$

$$S = \frac{1 + 3x - 2x}{1 - 2x + x^2} = \frac{1 + x}{(1 - x)^2} \text{ Ans}$$

6 What is the sum of the infinite series
$1 + 2x + 8x^2 + 28x^3 + 100x^4$ &c

Let $S = A + B + C + D$ &c sup m + n the relation
$C = Bmx + Anx^2$
$D = Cmx + Bnx^2$

$S = A + B + (Bmx + Anx^2) + (Cmx + Bnx^2)$
$S = A + B$ &c
$S - A = B + C$ &c

$S = A + B + (Smx - Amx) + (Snx^2)$
$1 - mx - nx^2 \mid S - Smx - Snx^2 = A + B - Amx$

$$S = \frac{A + B - Amx}{1 - mx - nx^2}$$

$$m = \frac{DC - BE}{CC - BD} = \frac{28 \times 8 - 2 \times 100}{64 - 2 \times 28} = \frac{24}{8} = 3$$

$$n = \frac{CE - DD}{CC - BD} = \frac{8 \times 100 - 28 \times 28}{64 - 2 \times 28} = \frac{16}{8} = 2$$

$$S = \frac{1 + 2x - 3x}{1 - 3x - 2x^2} = \frac{1 - x}{1 - 3x - 2x^2} \text{ Ans}$$

Continued Bill

1 What is the Sum of the infinite series

$1+4x+6x^2+11x^3+28x^4+63x^5$ &c

Let $S=A+B+C+D+E$ &c Suppose $m+n+r$ the Scale

$D=Cma+Bna^2+Ara^3$

$E=Dma+Cna^2+Bra^3$

$S=A+B+C+(Cma+Bna^2+Ara^3)+(Dma+Cna^2+Bra^3)$

$S=A+B$ &c

$S-A=B+C$ &c

$S-A-B=C+D$

$S=A+B+C+(Sma-Ama-Bma)+(Sna^2-Ana^2)+(Sra^3$

$1-mx-na^2-ra^3$ | $S-Sma-Snx^2-Srx^3=A+B+C-Ama-Bma-Ana^2$

$S=\dfrac{A+B+C-Ama-Bma-Ana^2}{1-ma-na^2-ra^3}$

$S=\dfrac{1+4x+6x^2-2x-8x^2+x^2}{1-2x+x^2-3x^3}=\dfrac{1+2x+x^2-2x^2}{1-2x+x^2-3x^3}=\dfrac{(1+x)^2-2x^2}{(1-x)^2-3x^3}$ Ans

2 What is the Sum of the infinite Series

$1+x+2x^2+2x^3+3x^4+3x^5+4x^6+4x^7$ &c

Let $S=A+B+C+D+E$ &c

$D=Cma+Bna^2+Ara^3$

$E=Dma+Cna^2+Bra^3$

$S=A+B+C+(Cma+Bna^2+Ara^3)+(Dma+Cna^2+Bra^3)$

$S=A+B$ &c

$S-A=B+C$ &c

$S-A-B=C+D$ &c

$S=A+B+C+(Sma-Ama-Bma)+(Sna^2-Ana^2)+(Sra^3$

$1-mx-na^2-ra^3$ | $S-Sma-Snx^2-Srx^3=A+B+C-Ama-Bma-Anx^2$

$S=\dfrac{A+B+C-Ama-Bma-Ana^2}{1-mx-nx^2-rx^3}$

$S=\dfrac{1+x+2x^2-x-x^2-x^2}{1-x-x^2+x^3}=\dfrac{1}{1-x-x^2+x^3}$ Ans

Ans

Infinite Series

Prob. 3 What is the 12th term of the series

2. 6. 12. 20. 30. &c a = 2
4. 6. 8. 10. D' = 4
2. 2. 2 D'' = 2
0. 0

$a+(n-1)D'+(n-1)\frac{n-2}{2}D''$
$2+(12-1)4+(12-1)\frac{12-2}{2}\times 2$
$2+44+110=156$ Ans

4th What is the 15th term of the series $1^2.\ 2^2.\ 3^2.\ 4^2.\ 5^2.\ 6^2$ &c

1. 4. 9. 16. 25. 36. a = 1
3. 5. 7. 9. 11 D' = 3
2. 2. 2. 2 D'' = 2

$a+(n-1)D'+(n-1)\frac{n-2}{2}D''$
$1+(15-1)3+(15-1)\frac{15-2}{2}\times 2$
$1+42+182=225$ Ans

Art 493 Prob 5 What is the ~~sum~~ sum of 20 terms of the series 1. 3. 6. 10. 15. &c

2. 3. 4. 5 a = 1
1. 1. 1 D' = 2
D'' = 1

$na+n\frac{n-1}{2}D'+n\frac{n-1}{2}\times\frac{n-2}{3}D''$
$20+20\times\frac{20-1}{2}\times 2+20\times\frac{20-1}{2}\times\frac{20-2}{3}$
$20+380+1140=1540$ Ans

6th What is the sum of 12 terms of the series $1^4.\ 2^4.\ 3^4.\ 4^4.\ 5^4.\ 6^4$ &c

1. 16. 81. 256. 625. 1296 &c a = 1
15. 65. 175. 369. 671 D' = 15
50. 110. 194. 302 D'' = 50
60. 84. 108 D''' = 60
24. 24 D'''' = 24

$na+n\frac{n-1}{2}D'=$
$=12+12\times\frac{12-1}{2}\times 15=990$
$n\frac{n-1}{2}\times\frac{n-2}{3}D''=12\times\frac{12-1}{2}\times\frac{12-2}{3}\times 50=11000$
$n\frac{n-1}{2}\times\frac{n-2}{3}\times\frac{n-3}{4}D'''=12\times\frac{12-1}{2}\times\frac{12-2}{3}\times\frac{12-3}{4}\times 60=29700$
$n\frac{n-1}{2}\times\frac{n-2}{3}\times\frac{n-3}{4}\times\frac{n-4}{5}D''''\ 220\times\frac{12-3}{4}\times\frac{12-4}{5}\times 24=$
$=19008$

19008
29700
11000
990
60698 Ans

5 B

Equtions By Wm H. McCormick

Prob. 2 What are the roots of the equation

Sup. 6 $x^3 - 8x^2 + 4x + 48 = 0$

$216 - 288 + 24 + 48 = 0$

$288 - 288 = 0$

$x - 6)\ x^3 - 8x^2 + 4x + 48\ (x^2 - 2x - 8$
$x^3 - 6x^2$
$-2x^2 + 4x$
$-2x^2 + 12x$
$-8x + 48$
$-8x + 48$

$x^2 - 2x - 8 = 0$
$x^2 - 2x = 8$
$x^2 - 2x + 1 = 9$
$x - 1 = \sqrt{9} = 3$
$x = 1 \pm 3 = 4$

$x + 2)\ x^2 - 2x - 8 = 0\ (x + 2$
$x^2 - 4x$
$2x - 8$
$2x - 8$

$x + 2 = 0$
$x = -2$
$x = 4$
$x = 6$ Ans

---

3 What are the roots of the equation

Sup 1 $x^3 - 16x^2 + 65x - 50 = 0$

$1 - 16 + 65 - 50 = 0$

$66 - 66 = 0$

$x - 1)\ x^3 - 16x^2 + 65x - 50\ (x^2 - 15x + 50$
$x^3 - x^2$
$-15x^2 + 65x$
$-15x^2 + 15x$
$50x - 50$
$50x - 50$

$x^2 - 15x = -50$
$x^2 - 15x + \frac{225}{4} = \frac{225}{4} - 50 = \frac{25}{4}$
$x - \frac{15}{2} = \pm\sqrt{\frac{25}{4}} = \frac{5}{2}$
$x = \frac{15}{2} \pm \frac{5}{2} = 10$

$x = 1$
$x = 5$
$x = 10$ Ans

$x - 10)\ x^2 - 15x + 50\ (x - 5 = 0$
$x^2 - 10x$
$-5x + 50$
$-5x + 50$

---

4 What are the roots of the equation

Sup 6 $x^3 + 2x^2 - 33x = 90$

$216 + 72 - 198 - 90 = 0$

$288 - 288 = 0$

$x - 6)\ x^3 + 2x^2 - 33x - 90\ (x^2 + 8x + 15$
$x^3 - 6x^2$
$8x^2 - 33x$
$8x^2 - 48x$
$15x - 90$
$15x - 90$

$x^2 + 8x = -15$
$x^2 + 8x + 16 = 16 - 15 = 1$
$x + 4 = \sqrt{1} = 1$
$x = -4 \pm 1 = -5$

$x + 5)\ x^2 + 8x + 15\ (x + 3 = 0$
$x^2 + 5x$
$3x + 15$
$3x + 15$

$x = 6$
$x = -5$
$x = -3$ Ans

---

5 What is a near value of the roots of the equation

$x^3 + 9x^2 + 4x = 80$ Sub $r + 3 = x$

$x^3 = (r+3)^3 = r^3 + 3r^2 3 + 3r 3^2 + 3^3$
$9x^2 = 9(r+3)^2 = 9r^2 + 18r3 + 9 3^2$
$4x = 4r + 43$

$r^3 + 9r^2 + 4r + 3r^2 3 + 18r3 + 43 - 80 = 0$

$3r^2 + 18r + 4 \mid 3r^2 3 + 18r3 + 43 = 80 - r^3 - 9r^2 - 4r$

$3 = \frac{80 - r^3 - 9r^2 - 4r}{3r^2 + 18r + 4}$

$\frac{80 - 15.625 - 56.25 - 10}{18.75 + 45 + 4}$

-1.875

67.75

$67.75)\ 1.8750\ (.03$
20325

2.5 = number tried

2.5
.03
2.47

Equations B₃ W. O. H.

$$\frac{80 - 14.068223 - 54.9081 - 9.88}{18.3027 + 44.46 + 4}$$

2.47, .02, Ans 2.49

$$\frac{1.1143677}{66.7627}$$ 66.7627) 1.1143677 (.02 near value x
1.335254

6 What is a near value of one of the roots of the equation $x^3 + x^2 + x = 100$ Sup 4.3

Sub $r + z = x$

$x^3 = (r+z)^3 = r^3 + 3r^2z + 3rz^2 + z^3$

$x^2 = r^2 + 2rz + z^2$

$x = r + z$

$r^3 + 3r^2z + r^2 + 2rz + r + z$

$3r^2 + 2r + 1 \,|\, 3r^2z + 2rz + z = 100 - r^3 - r^2 - r$

$z = \frac{100 - r^3 - r^2 - r}{3r^2 + 2r + 1}$

val. of z $\frac{100 - 79.507 - 18.47 - 4.3}{55.47 + 12.9 + 1} = \frac{-2.277}{69.37}$

69.37) -2.277 (-.03
2.081

4.3
.03
4.27 near value

2 What is a near value of one of the roots of the equation $x^3 + 10x^2 + 5x = 2600$ Sup 11.01

$x^3 = (r+z)^3 = r^3 + 3r^2z + 3rz^2 + z^3$

$10x^2 = 10r^2 + 20rz + 10z^2$

$5x = 5r + 5z$

$r^3 + 3r^2z + 10r^2 + 20rz + 5r + 5z = 2600$

$3r^2 + 20r + 5 \,|\, 3r^2z + 20rz + 5z = 2600 - r^3 - 10r^2 - 5r$

$z = \frac{2600 - r^3 - 10r^2 - 5r}{3r^2 + 20r + 5}$

$$\frac{2600 - 1334.633301 - 1212.2010 - 55.05}{363.6603 + 220.20 + 5}$$

225.20

588.8603) -1884301 (.003
1766580

-1334.633301
-1212.2010
-55.05
-2601.884301
2600
-1.884301

11.01
.003
11.007 near value &

Ans

What are the roots of the equation $x^3 + 2x^2 - 11x = 12$

Sup 3 $\frac{27 + 18 - 33 - 12}{45 - 45} = 0$

$x - 3) x^3 + 2x^2 - 11x - 12 (x^2 + 5x + 4$
$x^3 - 3x^2$
$5x^2 - 11x$
$5x^2 - 15x$
$4x - 12$
$4x - 12$

$x^2 + 5x = -4$

$x^2 + 5x + \frac{25}{4} = \frac{25}{4} - 4 = \frac{9}{4}$

$x + \frac{5}{2} = \sqrt{\frac{9}{4}} = \frac{3}{2}$

$x = -\frac{5}{2} \pm \frac{3}{2} = -4 \text{ or } -1$

$x = 3$
$x = -4$
$x = -1$ Ans

9

Prob 4 What are the roots of the equation

Sup 3 $x^4 + 4x^3 - 7x^2 - 34x = 24$

$81 + 108 - 63 - 102 - 24 = 0$

81 / 189 ; -63 / -24 / $189 = 0$

$x - 3 \;)\; x^4 + 4x^3 - 7x^2 - 34x - 24 = 0 \;(\; x^3 + 7x^2 + 14x + 8$ Sup -4

$x^4 - 3x^3$

$7x^3 - 7x^2$

$7x^3 - 21x^2$

$14x^2 - 34x$

$14x^2 - 42x$

$8x - 24$

$8x - 24$

$-64 + 112 - 56 + 8 = 0$

$8 \quad -64$

$120 - 120 = 0$

$x + 4 \;)\; x^3 + 7x^2 + 14x + 8 \;(\; x^2 + 3x + 2$

$x^3 + 4x^2$

$3x^2 + 14x$

$3x^2 + 12x$

$2x + 8$

$2x + 8$

$x^2 + 3x = -2$

$x^2 + 3x + \frac{9}{4} = \frac{9}{4} - 2 = \frac{1}{4}$

$x + \frac{3}{2} = \sqrt{\frac{1}{4}} = \frac{1}{2}$

$x = -\frac{3}{2} \pm \frac{1}{2} = -2$ or -1

$x = 3$
$x = -4$
$x = -2$
$x = -1$ Ans

Miscellaneous Questions Feb 23rd 1843

Prob 2d 4

Two sides of a triangle are 20 and 40 perches respectively required the third side so that the content may be just an acre Ans 23.099 or 58.876 P

$\frac{160}{20} = 8$

$\sqrt{20^2 - 8^2} = \sqrt{336} = 18.33$

40 − 18.33 = 21.661

3d In 110 Acres of Statute measure in which the pole is 5½ yds how many cheshire Acres where the customary pole is 6 yds and how many of ireland where the pole in use is 7 yds Ans 92A 1R 27P Cheshire 67A 3R 25P

7 : 5.5 :: 110 = 67A 3R 25P

4th 4

The ellipse in Grosvenor Square London meas 840 links the longer way and 612 the shorter within the rails now the wall being 14in thick it is requ to find what quantity of ground it encloses and how much it stands on Encloses 4A 0R 26P 1760 square ft

27.35
31.15
38
2 | 96.50 Sum
half sum 48.25
Rem { 20.90 / 17.10 / 10.25

Log. 1.68350
1.32015
1.23300
1.01072
2 | 5.24737
Ar 2.62368

10 | 420.4
A 42 . 04
4
16
40
P 6.40

A R P
34 = 1 = 11
42 = 0 = 6
41 = 1 = 19
117 = 2 = 36 Ans

40.10
23.70
29.25
2 | 93.05
46.525
{ 6.425 / 22.825 / 17.275
16 | 343.2
A 34 = 32
4
R 1.28
40
11.20

22.20
38.00
40.10
2 | 100.30
50.15
{ 27.95 / 12.15 / 10.05
16 | 413.7
A 41 = 37
4
R 1.48
40
P 19.20

---

8) Required the dimensions of an oblong garden containing 3 Acres and bounded by 104 Perches of Pale fence. Ans 40 P by 12

√26² - 480

26 ∓ 14 = 40 by 12

4 | 104
26
26
156
52
676
480
196 | 14
24 | 96
96

160
3
480

---

10) A gentleman has a garden 100 ft long and 80 broad and a gravel walk is to be made of equal width half round it. What must be the width of the walk so that may take up just ¼ of the ground. Ans 11.8975 ft

100
80
8000
40 4000
1000
100
10² √ 1100 ∓ 78.102

100
80
2 | 180
90
78.102
11.898 Ans

---

11. ~~A person has a garden 100 feet long and 80 broad and a gravel walk~~ A person has a circular park that is 150 ft in diameter and wishes a walk of equal width made round it within the fence. Required the width of the walk so that it may occupy a fifth part of the ground. Ans 7.418 ft

150 × 150 × .7854 = 17671.5000
.7854) 14137.2000 (18000

√18000 = 134.164
150
2 | 15.836
7.418

---

12) From a point within a triangular field the sides of which were equally ~~distant~~ I measured the distances to the three angles and found them 12, 10 and 7 ch. respectively. Required the area. Ans 12 ac 1 R [illegible]

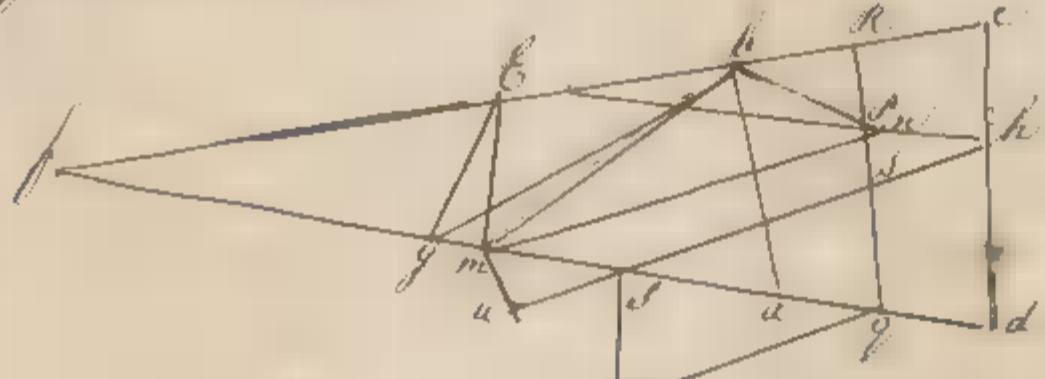
17) In a rectangular tract of land containing 58 A 3 R 8 P the difference of the lengths of the sides is just equal to the difference of the lengths of the longer side and the diagonal hence the sides are required
Ans. 21 & 28 ch.

Square 4 sides
triangle 3 do.

3 : 588 :: 4
4
3 | 2352
784 | 28 ans
4
48 | 384
384

40 | 18
4 | 3.2
58.8 | 16
588.0

4 : 588 :: 3
3
4 | 1764
441 | 21 ans
4
41 | 44

18) The boundries of a tract of land are as follows 1st N 14° W 15.20 ch; 2nd N 40½° E 20.43 ch 3rd S 6° E 22.49 ch 4th N 86½° W 18 ch to the place of beginning within the tract there is a Spring the bearing and distance of which from the 2nd corner is S 75° E 7.90 ch. it is required to cut off 10 A from the west side of this tract by a straight line running through the Spring what must be the distance of the division line from the first corner measured on the south side
Ans 4.6357 ch

S 23°
S 145° 30
7.90
11.452
S 23°
S 11° 30
7.90
4.031
S 23°
S 92° 30
15.20
37.10
S 23
S 84° 30
18.20
38.72
33.07 ar. co
19.36
37.10
21.72
33.07 ar. co
S 23
R 40°
Area 100
7.739
28.46 = log 1.46423
6.356 = log 0.81664
2 | 2.28087
13.898 = 1.14293

f b b e - 33.07
2 f a g 19.36
t h b p = 18.008
f m m i e p - 13.008
f k = k p = 11.45
k g - 8 h = 18.008
k g + h i = 24.64
k g - h i - 6.856
38° 30' - 23° - 11½
a q = b q - f a - f m + m i + i q - f a

21.72
7.739
13.898
43.357
38.72
a q 4.637 Ans

f 23°
e 23°
b 84½
a 92½
b 145½
f 11½°
Sum f°
a b 15.20
b c 20.43
c d 22.49
a d 18.00
e p 11.45
B e 4.031
B f 37.10
a f 38.72
f e 33.07
f g 19.36
f m 21.72
m e f
Area in Square ch
m i 7.739
P h 18.008
h i 11.45
i g 13.898
a q 4.637

145½
23
168½
180
11½

21.72
7.73
29.45
11.45
18.00

157 distance between the tops of the
diff of segments
Angle a
141°.16 angle ABD
64° 5' angle
34° angle
118°05'

Single Rule of Three

25 What must be paid for 53 ells English 1qr. of holland at the rate of 7s 9d1/4 per yard? Ans 25l 18s 1/4d

yds s d Ells qr
1 : 7-9 1/4 :: 53--1

28 What must be given for a piece of silver weighing 73lb. 5oz. 15dwt. at 5s 9d per ounce. Ans 253l 10s 0d 3/4

oz s d lb oz dwt
1 : 5-9 :: 73--5--15

Ans £253--10s 0d 3/4

26 What quantity of sugar may be bought for 26l 10s 4d when the price of 4C 2qr. is 15l 9s 2s Ans 7C 1qr

29 Bought 3 casks of raisins each weighing 3C. 1qr 7lb. neat: what will they cost at 2l 6s 6d per hundred weight. Ans £23-2-1 1/8

27 A person failing in trade owes 977l and the inventory of his effects amounts to but 420l 6s 3d1/4; how much will this produce per pound to his creditors? Ans 8s 7d1/4

£ £ s q £
977 : 420--6--3 1/4 :: 1

8--7 1/4 Ans

30 What will a tax upon 763l 15s be at the rate of 3s 6d per pound. Ans 133l 13s 1d1/2

£ 7 D £ S
1 : 3..6 : : 763..15
20 12 20
20 42 15275
42
30550
61100
20)641550
12)32077(10 = 1 / 20 = 2
20)2673..1
133..13..1 1/2 Ans

31 How many ells English of Holland may be bought for 25 l 18 s 1 d 3/4 at 7 s 9 d 1/2 per yard. Ans 53 E. 1 qr

S D yds £ S D
7..9 1/2 : 1 :: 25..18..1 3/4
4 20
93 518
4 12
374 6217
4
)24871(yds qr 66..2
2244 4
2431 5)266
2244 E 53..1 ans qr
187
4
748
748

32 What will 1 qr 1 na. of velvet cost at 18 s 6 d per yard Ans 5 s 9 d 1 1/2
yds S D qr na
1 : 18..6 :: 1..1
4 12 4
4 222 5
16 5
16)1110((12) 69 / 5..9..1 1/2 Ans
96
150
144
6
4
)24(D
16 1
8)8/16 = 1/2

33 A bankrupt compounds [illegible] with his creditors for 8 s 7 d 1/4 per pound and at that rate pays them 420 l 6 s 3 d 1/4 how much was he indebted Ans 977 £
S D £ £ S D
8..7 1/4 : 1 :: 420..6..3 1/4
12 20
103 8406
4 12
413 100875
4
)403501(977 ans
3717
3180
2891
2891
2891

34 What is the value of a silver tankard weighing 1 lb 7 oz 14 dwt at 6 s 4 d per ounce Ans 6 l 4 s 9 d 1/5
oz S D lb oz dwt
1 : 6..4 :: 1 7 14 dwt
20 12 12
20 76 19
20
394
76
2364
2758
20)29944
12)1497(4 = 1 / 20 = 5
20)124..9
6..4..9 1/5 Ans

35 What must be paid for 7 casks of prunes each weighing 2 C. 1 qr 14 lb. at 2 l. 19 s. 8 d. per hundred wight. Ans 49 l 11 s 11 d 1/2
lb £ S D cwt qr lb
112 : 2..19..8 :: 2..1..14
20 4
59 9
12 28
716 86
18
266
7
1862
716
11172
1862
13034
112)1333192((12) 11903 / 20)991..11
112 49..11..11 1/2 Ans
213
112
1011
1008
392
336
56)56/112 = 1/2

36 At 1 l 7 s 8 d per acre what is the annual rent of 173 A 2 R 14 P Ans 240 l 2 s 7 d
A £ S D A R P
1 : 1..7..8 :: 173..2..14
4 20 4
4 27 694
40 12 40
160 332 27774
332
55548
83322
83322
160)9220968((12) 57631 / 20)4802..7
800 240..2..7 Ans
1220
1120
1009
960
496
480
168
160

37 If 5 yards of cloth cost 1£ 5s 2d what must be given for 9 peces containing each 21 yds 1 qr Ans 27£ 1s 10d ½

21 - 1
4
85
765
...
55550
765
20)130050
12)6502 - 10/20 - ½
20)541 - 10
27 - 1 - 10½ Ans

38. If a persons estate be worth 3858 dollars 24 cents a year out of which he saves 1200 dollars how much per day will the remainder be. Ans 7,28+

days D C day
3858 24
1200
365 : 265824 : : 1
)265824 (7,28+ c Ans
2555
1032
730
3024
2920
204

39 If a mans annual income be 1333 dollars and he expends daily 2 dollars 14 cents how much will he save at the years end Ans 551,90

day D C days
1 : 214 : : 365
214
1460
365
730
1333
781 10
551 90 Ans 78110

40 If a staff 4 feet long cast a shade (on level ground) 7 feet what is the height of that steeple whose shade at the same time measures 198 feet 113 ft 1/7 ans

ft ft ft
7 : 4 : : 198
4
7)792
113 1/7 Ans

41 The earth being 360 degrees in circumference turns round on its axis in 24 hours. how far are the inhabitants at the equator carried in one minute degree there being 69½ miles? Ans 17 M 3 fur

H deg M
24 : 360 : : 1
60 360
1440 69½
3240
2160
180
1440)25020 (17 - 3 Ans M fur
1440
10620
10080
540
8
4320 (3 fur
4320

42 A merchant would lay out in spices 1498 dollars Viz. cloves at 53 cents per pound mace at 94 cents cinnamon at 40 cents and nutmegs at 27 cents and he would have an equal quantity of each sort what must quantity be? Ans 700 lb of each sort.

C
53
94
40
27
214 : 1 : : 149800 lb D C
149800 (700 lb ans
1498 00

43 A goldsmith bought of a merchant 14 lb 3 oz 8 dwt of gold for 1371 dollars 20 cents how much per ounce Ans 8 dollars

lb oz dwt D C oz
14 - 3 - 8 : 137120 : : 1
12 20
171
20
3428) 2742400 (800 Ans
27424 00

44 How many reams of paper at 1 dollar 66 cents. 1 dollar 97 cents and 2 dollars 31 cents per ream and of each an equal number may be purchased with 528 dollars 66 cents Ans 89 reams of each sort

Single Rule of Three Inverse

2 What quantity of shalloon that is 3 qrs of a yard wide will line 7½ yards of cloth that is 1½ yard wide? Ans 15 yards.

qr yds yds
3 : 7½ :: 1½
4 4
30 6
3
6)90
15 Ans

3 If 100 men can finish a piece of work in 12 days how many are sufficient to do it in three days. Ans 400 men.

days men days
12 : 100 :: 3
100
3)1200
400 Ans

4 How much in length that is 4½ inches broad will make a square foot Ans 32 inches

in in in
144 : 1 :: 4½
2 2
9)288 9
32 Ans

5 How many yards of matting 2 feet 6 inches broad will cover a floor that is 27 feet long and 20 broad Ans 72 yards.

ft ft ft in
20 : 27 :: 2 .. 6
12 12
240 30
27
1680
480
30)6480
3)216
72 yards

6 How many yards of cloth 3 qrs wide are equal in measure to 30 yards of 5 qrs wide Ans 50 yards

qr yds qr
5 : 30 :: 3
30
3)150
50 Ans

7 If 100 l principal in 12 months gain 6 l. interest what principal will gain the same in 8 months Ans 150 £

M £ M
12 : 100 :: 8
100
8)1200
£150 Ans

8 How many yards of paper 1¼ yards wide will be sufficient to hang a room which is 20 yards in circumference and 4 in height Ans 64 yards.

yds yds yds
4 : 20 :: 1¼
4 16 4
16 120 5
20
5)320
64 Ans

9 How many men must be employed to finish a piece of work in 15 days which 5 men can do in 24 days? Ans 8 men

days men days
24 : 5 :: 15
5
15)120
120 (8 Men

10 In how many days will 8 men finish a piece of work which 5 men can do in 24 days ans 15 days

men days men
5 : 24 :: 8
5
8)120
15 Days

11 If a footman perform a journey in 3 days when the days are 16 hours long how many days will he require of 12 hours long to perform the same in Ans 4 days
H days H
16 : 3 :: 12
3
12)48
4 Days Ans

12 If 6 men can reap a field of wheat in 12 days in what time will 24 men do it Ans 3 days.
men days men
6 : 12 :: 24
6
24)72
72 (3 days

13 How much in length that is 8 poles in breadth must be taken to contain an acre Ans 20 perches
P P P
160 : 1 :: 8
1
8)160
20 (P Ans

14 A lent B 500l for 6 months: how long ought B to lend A 220l to be equivalent Ans 13 mo 19 da
£ M £
500 : 6 :: 220
6
220)3000 (13 mo 19+ da Ans
220
800
660
140
30
)4200 (19 da
220
2000
1980

15 If when the price of a bushel of wheat is 4s 6d. the penny loaf weighs 12oz what must the penny loaf weigh when a bushel is worth but 3s Ans 18oz

S D oz S
4 - 6 : 12 :: 3
12 12
54 36
12
36)648 (18oz Ans
36
288
288

16 What is the weight of a peas to a steelyard which being suspended 39 inches from the center of motion will equipoise 208lb suspended at the draught end 3 quarters of an inch. Ans 4lb
qr lb in
3 : 208 :: 39
3 4
156
156)624
624 (4lb Ans

17 Suppose 800 persons in garrison with provision sufficient for two months: how many must depart that the provision may serve them 5 months
M persons M ans 480
2 : 800 :: 5
2
5)1600
320
800
320
480 Ans

18 How many yards of matting that is half a yard wide will cover a r[illegible] that is 18 feet wide 30 long. Ans 120 yds
ft ft ft in
18 : 30 :: 1 - 6
12 12
216 18
30 (3)
18)6480 (360
54 120 Ans
108
108
0

19 How wide must a lot of ground be to contain an acre when it is 13 1/2 poles in length Ans 11 P. 4 yds 2 ft 0 in 2 b.c

P P P
160 : 1 :: 13½
2 2
27)320(11 P 27
27
50 P yds ft in b.c
27 11 .. 11 .. 2 0 2
23
5½
115
11½
126½
2
27
54)253(4 yds
216
37
3
54)111(2 ft
108
3
12
36
3
54)108(2 b.c
108

20 If when the price of a bushel of wheat is 6s 3d the penny loaf weighs 9oz. what ought it to weigh when wheat is at 8s 2¼ per bushel Ans 6oz. 13dr

s D OZ s D
6 .. 3 : 9 :: 8 .. 2¼
12 12
75 98
4 4
300 394
9
394)2700(6oz. [illegible] dr Ans
2364
336
16
2106
336
1976(13 dr
394
1436
1282
154

21 In what time will 600l gain 50l interest when 80l would gain it in 15 years? Ans. 2 years.

£ Years £
80 : 15 :: 600
80
600)1200(
2 years Ans

Application 128

1 If 3 quarters of a yard of velvet cost 7s 3d how many yards can I buy for 13l 15s 6d Ans 28 yds. 2 qr.

£ s D qr s D
13 .. 15 6 : 3 :: 7 3
20 12
275 87
12
3306
3 yds
87)9918(114
87 28 .. 2 .. Ans
121
87
348
348

2 If an ingot of gold weighing 9lb. 9oz 12dwt be worth 411l 12s. what is that per grain Ans 1d¾

lb oz dwt £ s gr
9 .. 9 .. 12 : 411 .. 12 :: 1
12 20
117 8232
20 8232
2352 12
24 D
9408)98784(1¾ Ans
4704 56448
56448)42336 = 3
14112 56448 = 4

3 A borrowed of B 250l. for 7 months and in return lends him 300l. how long ought B to keep it that the interest of it may be equal to that of the first sum Ans 5 mo. 25 da.

£ mo £
250 : 7 :: 300
7
300)1750(5 mo. 25 da. ans
1500
250
30
)7500(25
600
1500
1500

4 If a persons income be 500 guineas a year and he spend 19s 7d sterling per day how much will he have saved at the years end Ans 167l 12s 1d. sterling.

d s D days
1 : 19 - 7 :: 365
12 235
235 1825
1095
730
12)85775
20)7147 - 11
357 - 7 - 11

£
500
21
500
1000
2)10500
525
357 - 7 - 11
£167 - 12s - 1D Ans

5 At 13s.2d½ per yard what is the value of a piece of clothe containing 52 English ells and 3 qrs Ans 43l 8s 5d¼.

yds s D Ells qr
1 : 13 - 2½ :: 52 - 3
4 12 5
4 158 263
4 634
634 1052
789
1578
4)166742
4)41685 - 2
12)10421 - ¼
20)868 - 5
43 - 8 - 5¼ ans

6 If 30 men can perform a piece of work in 11 days: how many men will accomplish another piece of work four times as large in 12 days? Ans 110 men.

days men days
30
11 : 4 :: 12
120
11
120
120
12)1320
110 men Ans

7 The rents of a whole parish amount to 1750l on which is assessed 32l 16s 3d. what is that in the pound. ans 4d ½

£ £ s D £
1750 : 32 - 16 - 3 :: 1
20 20 20
35000 656 12
12 12 240
420000 7875
240
315000
1575
1890000 (4½ Ans
1680000
210000 4
840000 (2/4
840000

8 Bought three tons of oil for 151l 14s. 85 gallons of which being damaged I desire to know how I may sell the remainder per gallon so as neither to gain nor lose thereby Ans 4s 6d¼

T £ s gal
3 : 151 - 14 :: 1
4 20
12 3034 (4s 6d¼ Ans
63 2684
36 350
72 12
756 4200 (6 D
85 4026
671 174
4
696 (1/4
671

9 If the carriage of 5c. 14lb for 96 miles be 32s 6d how fair may I have 3c. 1qr carried for the same money?
Ans 151 M. 3 fur. 3 P.

c lb M c qr
5 - 14 : 96 :: 3 - 1
4 4
20 13
28 28
174 104
40 16
574 364
3444
5166
55104 (151 M
364
1870
1820
504
364
1400
8
11200 (3 fur
1092
280
40
11200 (3 P
1092

10 Bought 200 yards of cambric for 90l which being damaged am willing to lose 7l 10s by the whole at what rate then must it sell per ell English Ans 10s 3d 3/4

yds 90 5 Ell
7..10
200 : 82..10 :: 1
4 20
800 1650
5 5 D
800)8250(10.. 3/4 Ans
800
250
12
)3000(3
2400
600
4
)2400(3/4
2400

11 If for 4l 5s 225C. be carried 512 miles how many hundred weight may be carried 64 miles for the same money Ans 1800 C

M cwt M
512 : 225 :: 64
512
450
225
1125 cwt
64)115200(1800 Ans
64
512
512 00

12 Bought a parcel of cloth at the rate of 6s 6d. for every two yards of which a certain quantity was sold at the rate of 18s 9d. for every five yards and gained thereby as much as 180 yds cost; how many yards were sold Ans 1170 yards

S D S D
2)6..6 5)18..9
3..3 3..9
3 3
6
S D
6..6
12
78
D 180÷90
yds
6 :: 1 :: 7020
)7020
1170 Ans

13 A certain steeple projected upon level ground a shadow to the distance of 633 ft 4 in when a staff 3 feet in length perpendicularly erected cast a shadow 6 ft. 4 in from hence the height of the steeple is required.

ft in ft Ans 100 yds
ft in
6..4 : 3 :: 633..4
12 12
76 7600
3
76)22800(300
22800 100 Ans

14 If 12 yards of yard wide silk exactly line 8 yards of silk of another breadth: how many yards of the latter will line 24 pieces of the former each piece containing 20 yards? Ans 320 yards.

yds yds 24
12 : 8 :: 20
480
8
)3840
320 Ans

15 Laid out 100l. upon serges and shalloons: the value of the shalloons was 60l and the quantity of serge 237 yards also for every two yards of serge there were three of shalloon how many yards of shalloon were there and what was the value of one yard of each sort. Ans 355 1/2 yds. shalloon 3s 4d 1/2 + each per yard

£
100 yds £
60
110 : 237 :: 60
60
110)14220
355 1/2 yards

£
40
20
237)800 (3 s 4 d 1/4 qr ans
711
89
12
)1068 (4 d
948
120
4
)480 (2/4
474
6

16 How many pieces of Holland each 33 ells Flemish 1 qr 2 na may be had for 118 l 17 s 7 1/2 d when 4 ells English cost 1 l 7 s 10 d Ans 16 pieces 33 ells 1 qr 1 na

£ s d ells £ s d
1..7..10 : 4 :: 118..17..7 1/2
20 20
27 2377
12 12
334 28531
4 4
1336 114126
4 ells English
1336)456504 (341
4008
5570
5344
2264
1336
928
4
)4640 (3 qr
4008
632
4
)2528 (1 na

Flem qr na
33..1..2
3
100
4
402 ells English
341..3..1
5
1708
4 pieces Ells qr na
402)6833 (16 -- 33 -- 1 -- 1 Ans
402
2813
2412
401 remainder
4)400
3)100..1
33..1..1
ells qr na

17 A factor bought 64 pieces of Holland which cost him 352 l. at 5 s 6 d. per ell Flemish: how many yards were there in all and how many ells English in each piece Ans 960 yds. 12 ells each piece

s d ells £
5..6 : 1 :: 352
12 20
66 7040
12 ells
)84480 (1280
66
184
132
528
528

ells Flem
1280
3
4)3840
960 yds Ans

ells Flem
1280
3
5)3840
pieces 64)768 (12 ells each piece ans
64
128
128

18 If a pole perpendicular to the horizon of 50 ft. 11 in. in length when the sun is on the meridian cast a shadow 98 feet 6 in. long; what is the breadth of a river that running due east and west within 20 ft. 6 in on the north side of the foot of a steeple, 300 ft. 8 in. high which at the same time casts the extremity of its shadow 30 ft. 9 in. beyond the stream

Ans 176 yds. 2 ft. 4 in.

feet in : ft in :: ft in
50..11 : 98..6 :: 300..8
12 12 12
611 1182 3608
1182
7216
28864
3608
3608
611) 4264656 (6979
3666
5986
5499
4875
4277
5986
5499

feet in
20..6
30..9
51..3
12
615

in
6979
615
12) 6364 (..4
3) 530
176..2..4
yds Ans

---

19 Of what length must a board be that is 7½ in. wide to measure 20 square feet?
Ans 32 feet

in : in :: in
7½ : 1 :: 144
2 20
15 2880
2
15) 5760 (384
45 32 ft
126
120
60
60

---

20 A and B depart from the same place and travel the same road: but A goes 5 days before B at the rate of 20 miles a day: B follows at the rate of 25 miles a day; in what time and what distance will he overtake A. Ans 20 days and 500 miles

M day
5 : 1 :: 20
5
100
5) 100 dys
20
25
100
40
500 miles

---

21 If 58 gallons of water in one hour fall into a cistern containing 230 gallons and by a pipe in the cistern 35 gallons run out in an hour; in what time will it be filled Ans 15h. 20m in

gal H gal
58
35
23 : 1 :: 230
23) 230 (10 H ans
23
0

---

22 A certain cistern has four pipes: by the first it will be filled in 10 minutes by the second in 20. by the third in 40 and by the fourth in 80: in what time will all four running together fill it?
Ans 5 min. 20 sec.

M M M M
10 20 40 80
20
200
40
8000
80
640000

10÷ 64000
20÷ 32000
40÷ 16000
80÷ 8000
M
120000 : 1 :: 640000 m s
640000 (5..20 ans
600000
40000
60
2400000
2400000 0

---

23 Astronomers compute the earth's orbit or track which it describes round the sun in 365 days 6 hours to be about 596900000 miles: how far then per minute must we be carried through the firmament by this wonderful motion Ans
1134+ miles

days 36
365 . . 6
24
1466
730
8766
60
525960 : 596900009 : : 1 M
Miles

)596900000 (1134+ miles Ans
525960
709400
525960
1834400
1577880
2565200
2103840

---

24 Isaac Newton and others have found by nice experiments that sound flies at the rate of 1142 feet per second and a person in health has about 75 beats of the artery or pulsations in a minute: now the breadth of a river is required at one side of which A. firing a gun B. directly opposite at the other counts six pulsations at his wrist between seeing the flash and hearing the report Ans 5481 ft. or 1 mile 201 ft

Puls ft 1142 Pulsations
60
75 : 68520 : : 6
6
75)411120 (5481 ft Ans
375
361
300
612
600
120

ft ft
5280)5481 (1 mile 201 ft Ans
5280
201

---

25 If the report of a piece of ordinance be heard one minute and three seconds after the flash was observed: the distance is required. Ans 13 mils 5 furlongs.

sec ft M sec
1 : 1142 : : 1 . . 3
63 60
3426 63
ft 6852
5280)71946 (13 Miles
5280
19146
yds 15840
220)3306 (5 furlongs
3
660)3300
6

Last Sum

the Double Rule of Three

Suppose 4 men in 12 days mo w 48 acres: how many acres can 8 men mow in 16 days? Ans 128 acres.

4 m } A { 8 m
12 d } 48 { 16 d
48   128
48
1024
512
48) 6144 (128 acres Ans
48
134
96
384
384

3 If 12 oxen in 16 days eat 20 acres of grass: how many acres will serve 24 oxen 48 days. Ans 120 acres.

12 ox } A { 24 ox
16 d } 20 { 48 d
72
12
192
192
96
1152
20   A
)23040 (120 ans
192
384
384
0

4 If 10 bushels of oats be sufficient for 18 horses 20 days: many bushels will serve 60 horses 36 days at that rate Ans 60 bushels.

18 h } B { 60 h
20 d } 10 { 36 d
360
2160
10
)21600 (60 bush Ans
2160
0

5 If 56 lb. of bread be sufficient for 7 men 14 days: how many pounds will suffice 21 men 3 days. Ans 36 lb.

7 m } lb { 21 m
14 d } 56 { 3 d
98
63
56
378
315
)3528 (36 lb Ans
294
588
588

6 If 8 men have 3 l 4 s. for 4 days work: how much ought 48 men to receive for 16 days. Ans 76 l 16 s.

8 m } L S { 48 m
4 d } 3 .. 4 { 16 d
32   20
64
288
48
768
64
3072
4608
32) 49152 (1536
32   76 .. 16
171   L S
160   Ans
115
96
192
192

7 If 700 dols. in half a year raise 14 dols. interest: what will be the interest of 400 dols. for 5 years? Ans. 80 dols.

700 d } D { 400 d
1/2 y } 14 { 5 y
350
2000
14   dols
350) 28000 (80 Ans
2800
0

8 If 112 acres of grass be mowed by 16 men in 7 days: how many acres may 24 men mow in 19 days. Ans 456 acres.

16 m, 7 d } 112 A { 24 m, 19 d

112) 51072 (456 Ans

---

9 If 16l 18s. be the wages of 16 men for 8 days: what sum will 32 men earn in 24 days? Ans 101l 8s.

16 m, 8 d } £16..18 { 32 m, 24 d

128) 259584 (2028 — £101..8 Ans

---

10 If 75l. in 9 months amount to 78l 7s 6d. at what rate per cent is the interest computed Ans 6l. per cent

£78..7..6 − 75 = 3..7..6 ; 75£ × 9 M = 675 ; 100£ × 12 M = 1200

675) 972000 (1440 ; (20) 72 = 6£ Ans

---

11 Suppose the wages of 6 persons for 21 weeks be 120l what will be the hire of 14 persons for 46 weeks. Ans 613l 6s 8d.

6 P, 21 w } £120 { 14 P, 46 w

126) 77280 (613..6..8 £ ans

---

12 What is the interest of 259l 13s 5d. for 20 weeks at 5 per cent? Ans 4l 19s 10¼

52 wee, 100£ } £5 { 20 w, £259..13..5

1248000) 6232100 (4 £ ; (19 S ; (10 D ; (1/4 fa

---

13 If 2 men can do 12 rods of ditching in 6 days: how many rods may be done by 8 men in 24 days. Ans 192 rods.

2 m, 6 d } R 12 { 8 m, 24 d

12) 2304 = 192 rods ans

14 If the carriage of 8cwt. 128 miles cost 640; what must be paid for the carriage of 4c.wt. 32 miles. Ans 80cts

8cwt } 128 m } 1024 — C 640 — { 4 cwt { 32 m

128
640
5120
768
81920 (80cts
8192 Ans

15 If 200lb be carried 40 miles for 40 cts. how much must be paid at that rate for the carriage of 20200lb. 60 miles. Ans 60,60 cts

200lb } 40 m } 8000 — C 40 — { 20200 lb { 60 m

1212000
40
48480000 (60,60 Ans

16 If the freight of 9 hogsheads of sugar each weighing 12 hundred weight for 20 leagues cost 16l. what must be paid for the freight of 50 casks of of ditto each weighing 2½ hundred weight 100 leagues Ans 92l 11s 10d

9×12=108c } 20l } 2160 — £ 16 — { 125 = 2½×50 c { 100 leagues

12500
16
75000
12500
2160) 200000 (92--11--10 £ S D Ans
19440
5600
4320
1280
20
25600 (11 S
2160
4000
2160
1840
12
22080 (10 D
2160
480

Inverse proportion

2 If 4 ~~dollars~~ be the hire of 8 men for three days: how many days must 20 men work for 40 dols Ans 12 days

4d } 8m } 20 80 — days 3 — { 40d { 20 m

8
320
3
960 (12 Ans

3 If 4 men have 24 shillings for three days work: how many men will earn 4l 16s in 16 days. Ans 3 men

24s } 3d } 16 144 24 384 — men 4 — { 96s = 4l - 16 s { 16d

3
288
4
1152 (3 men ans
1152

11 Suppose the interest of 333l 6s 8d for 9 months be 15l what principal in 12 months will gain 6l Ans 100l.

15£ } 9m } 54 — £ s d 333-6-8 20 6666 12 80000 — { 6£ { 12 m 180

180) 4320000 (24000
360
720
720
000
(20)2000
100 £ Ans

5 If 200lb be carried 40 miles for 40cts: how far may 20200lb be carried for 60,60. Ans 60 miles.

~~200lb~~ } 40cts } — miles 40 — { 20200 lb { 60,60cts

20200
40
808000

200
1212000
40 miles
808000) 48480000 (60 ans
4848000
0

6. If 1145 men can make a wall 32 feet high and 40 feet long in 8 days: in how many days can 68 men build a wall 28 feet high of the same length. Ans 141 days 11 h.+

1145 m } days { 68 m
32 ft } 8 { 28 ft

68 × 32 = 2176 … 1145 × 28 = 40600 days × 8 = 324800 ÷ 2176 (141 days … 11+ h

---

7. If a foot man when the days are 14 hours long can travel 276 miles in 16 days: in how many days can he travel 852 miles when the days are but 12 hours long: Ans 57 days 7 hours+

14 h } days { 12 h
276 m } 16 { 852 m

276 × 12 = 3312 … 852 × 14 = 11928 × 16 = 190848 ÷ 3312 (57 days … 7+ hours

---

8. If 15 men eat 3 shillings worth of bread in 6 days when wheat is sold at nine shillings per bushel: how many days will 30 men require to eat 13 s. 4 d. worth when wheat is at 6 s. per bushel. Ans 20 days.

s 3 = 36 d } men { 160 d = 13 s. 4 d
15 m } 6 { 30 m

36 × 30 = 1080 × 6 = 6480 … 160 × 15 = 2400 × 6 = 14400 × 9 = 129600 ÷ 6480 (20 days

---

9. If 100 l. principal in 12 months gain 8 l. interest: what principal will gain 8 l. 12 s. in 5 months. Ans 258 l.

l 8 = 160 s } 12 m } l 100 { 5 m { 172 d = 8 l. 12 s

8 × 5 = 800 … 20640 … 2064 00 ÷ 800 … 258 l Ans

---

10. Suppose 100 l. will defray the expences of 5 men for 22 weeks and 6 days: how long will 12 men be spending 150 l. Ans 14 weeks 2 days.

100 l } weeks D { 150 l
5 m } 22 … 6 { 12 m

5 × 12 = 1200 … 160 … 150 × 5 = 750 × 160 = 120000 ÷ … 14 … 2 Ans weeks days

---

Application.

1. If 7 bushels of malt be sufficient for 7 persons 4 months how many bushels will serve 116 persons 10 months. Ans 115 bushels.

```
7P  } B  { 116 P
4m  } 7  { 10 m
28         460
           7
      )3220(115 bushels
       28       Ans
       42
       28
       140
       140
```

2 How many men must be employed to reap 240 acres in 12 days if 36 men can reap 60 acres in 5 days.
Ans 60 men.

```
60 A } men { 240 A
5 d  } 36  { 12
12           5
720        1200
             36
           7200
          3600
        )43200(60 men
         4320  Ans
```

3 If 5 men make 300 pair of shoes in 40 days how many men may make 900 pair in 60 days. Ans 10 men.

```
300 P } men { 900 P
40 d  } 5   { 60 d
60            40
18000       36000
                5
          )180000
           10 men Ans
```

4 A porter having received 42 shillings for the carriage of 3 C. wt. 150 miles. how much ought he to have for the conveyance of 7 C. 2 qr. 14 lb. 50 miles? Ans 35 S 7 d.

```
cwt
3 = 336 lb } S  { 854 lb = 7.2.14
    150 m  } 42 { 50 m
16800            42700
336                 42
50400            85400
               170800
             )1793400(35 S
              151200
               281400
               252000
                29400
                   12
             )352800(7 D
              352800
```

5 A person having engaged to remove 8000 C. wt. a certain distance in 9 days. with 18 horses in 6 days he removed 4500 cwt. how many horses will be required to remove the remainder in the remaining 3 days. Ans 28 horses.

```
4500 C } horses { 8000
6 d    } 18     { 4500
3                 3500 C
13500              3 d
                     6
                 21000
                    18
                168000 horses
                21000
             )378000(28
              27000   Ans
              108000
              108000
```

6 If 20 hundred weight be carried 50 miles for 5 l how much will forty hundred weight cost to be conveyed 100 miles Ans 20 l.

2000 C } 50 m } £ 5 { 1100 C { 100 m

100000) 1100000 × 5 = 12000000) 20 £ Ans

---

7 A farmer having sown 118 bushels found that it produced 576 bushels the first year; now supposing he sows 240 bushels of grain each year for 6 years successively: what will be his whole increase at the expiration of the last year: Ans 17280 bushels.

118 B } 1 y } B 576 { 240 B { 6 y

118

1440 × 576 = 8640, 10080, 7200

118) 829440 (17280 B

118, 849, 836, 134, 96, 384, 384, 0

---

8 If 12 men in 6 days reap 80 acres: in how many days will 25 men reap 200 acres. Ans 7 1/5 days.

12 m } 80 A } days 6 { 25 m { 200 A

25 → 2000

12 → 2400 × 6

2000) 14400 (7 1/5 Ans

14000

400) 2000 = 1/5

---

9 An usurer put out 86 l. to receive interest for the same and when it had continued 8 months he received for principal and interest 88 l 17 s 4 d. query the rate per cent

Ans 5 per cent.

£ S D

88 ~ 17 ~ 4

86

2 ~ 17 ~ 4

86 £ } 8 m } 2 ~ 17 ~ 4 × 20 = 57 × 12 = 688 { 100 £ { 12 m

688) 825600 (1200 d

20) 1200 = 5 £ ans

Practice

Practice

2 Bought 9 T. 19 C. 3 qr. 27 lb 3/4 of iron, at 39 l 19 s 11 d. 1/2 per ton; what was the amount. Ans 399 l. 19 s 11 d. +

		£	S	D
		39	19	11 1/2
				9
cwt 10	1/2	359	19	7 1/2
4	2/5	19	19	11 3/4
4	5	7	19	11 3/4
1	4	1	19	11 3/4
qr 2	1/2	1	19	11 3/4
1	2	0	19	11 3/4
		0	09	11 3/4
		0	04	11 3/4
lb 14	1/2	0	02	5 3/4
7	2	0	01	5
4	7	0	00	8 1/2
2	2	0	00	2
3/4 1/2	4	0	00	1
1/4	2			
		399	19	4 Ans

Tare and Trett

2 what is the neat weight of 1156 C. 1 qr. 19 lb of tobacco tare in the whole 15 C. 2 qr. 13 lb. and what is the amount there of at 1 l 15 s 8 d. per cwt. Ans neat 1140 C. 3 qr 6 lb. amount 786 l 1 s 11 d 3/4

cwt	qr	lb
1156	1	19
15	2	13
1140	3	6

		£	S	D
		1	15	8
2	4			10
1	2	17	16	8
	1			10
4	2	178	6	8
2	1			4
	7	713	6	8
	1	71	6	8
	2		17	10
			8	11
			1	3 1/4
			0	7 1/2
		786	1	11 3/4

3 How much is the neat weight of 36 hogsheads of tobacco weighing gross 201 C. 3 qr. 12 lb. tare in the whole 3140 lb. and what does it come to at 1 l 17 s 6 d. per hundred weight. Ans neat 173 C. 3 qr. 8 lb. value 325 l 18 s 3 d 1/2

lb
112) 3140 (28 — 0 — 4
224
900
896
4

201 — 3 — 12
28 — 0 — 4
173 — 3 — 8 neat Ans

lb £ S D cwt qr lb
112 : 1 — 17 — 6 :: 173 — 3 — 8

4 What is the neat weight of 5 casks of sugar weighing as fol lows Viz. No. 1 4C. 2qr. 14lb. gross tare 21lb. No. 2 3C. 0qr. 17 lb. gross tare 18lb. No. 3. 5C. 3qr. 10lb gross tare 1qr. 11 lb. No. 4. 6C 1qr. 16 lb. gross tare 27lb. No. 5. 3C 2 qr. 18 lb gross tare 19lb, And the neat of the three first at 2l 4s 7d per hun dred weight of the other two at 2l 17s 6d. what do they amount to Ans neat 22C. 2qr. 7lb. amount 56l 10s 5 3/4

No cwt qr lb | qr lb |
1 4 - 2 - 14 | 21 | 27
2 3 0 17 | 18 | 17
3 5 3 10 | 1 11 | 1 - 18
13 2 13 | 2 - 22
2 22
12 - 3 - 19
9 2 16
22 - 2 - 7 Amount Ans

No 4 | 6 - 1 - 16
5 | 3 - 2 - 18
10 - 0 - 6
1 18
9 - 2 - 16

lb £ S D cwt qr lb
112 : 2 - 4 - 7 : : 12 - 3 - 19
lb £ S D cwt qr lb
112 : 2 - 17 - 6 : : 9 - 2 - 16

Case 2

2 In 70 bales of silk each 317 lb. gross: tare per bale 16 lb. how many pounds neat and what do they am ount to at 12s 6d per pound Ans neat 21070 lb amount 13168l 15s.

lb
317
70
22190
1120
21070 amount

lb
16
70
1120

S D
12 - 6
10
6 - 5 - 0
10
62 - 10 - 0
10
625 0 0
10
6250 0 0
2
12500 0 0
625 0 0
43 15 0
13168 - 15 - 0 Ans

3 What is the neat weigt and value of 16 hogsheads of tobacco weighing 86C. 2qr. 14lb. gross tare 100 lb. per hogshead: the neat sold at 3l 15s 10d per cwt Ans neatt 72C 1qr 10lb value 274l 5s 8d 3/4

16
100
28) 1600 (57
140
200
196
4
1 - 1 - 4

cwt qr lb
86 - 2 - 14
14 1 4
lb £ S D
112 : 3 - 15 - 10 : : 72 - 1 - 10

4 Sold 4 casks of indigo wei ghing gross 18C. 2qr. tare 37lb per cask: what is the neatt weight and value thereof at 4s 6d per lb. Ans neat 17C. 20lb value 432l 18s.

lb
37
4
28) 148 (5
140
8
1 - 1 - 8

cwt qr lb
18 - 2 - 0
1 1 8
17 - 0 - 20 neat

17 - 0 - 20
4
68
28
544
1384
lb S D
1 : 4 - 6 : : 1924

Case 3

2 What is the neat wei ght and value of 40 kegs of figs gross 75C. 3qr. 14 lb tare per hundred weight 14lb at 18s 6d. per cwt Ans neat 66C. 1qr. 16 lb. value 61l 8s 3 3d

lb S d 14 1/2 | cwt qr lb 75-3-14 / 9 1 26
112 : 18-6 :: 66-1-16

3 Sold 9 hogsheads of sugar each 6C. 2qr 12 lb. gross tare per hundred weight 17 lb wh at is the neat weight: and wh at does it amount to at 2 l 12 S 6 d per hundred weight
Ans neat 50C 1qr 22 lb amou nt 132 l 8 S 5 d 1/4

cwt qr lb 6-2-12 / 9 / 59-1-24

59-1-24 / 9 0 2 / 50 1 22 neat

237 / 28 / 1900 / 476 / 66660 / 17 / 466620 / 66660 / 112) 1132220 (28) 1010 (84 / 170 / 168 / 2

lb £ S d cwt qr lb
112 : 2-12-6 :: 50-1-22

4 Bought 4 hogsheads of sugar weighing 43C. 3qr 21 lb gross tare 12 lb per hundred weight required the neat weight and its va lue at 2 l 15 S 4 d per hund red weight Ans neat 39C 25 lb 12 oz value 108 l 10 S 7 d 3/4

cwt qr lb 43-3-21 / 4 / 175 / 28 / 1401 / 352 / 4921 / 12 / 59052

cwt qr lb oz 43-3-21-0 / 4-2-23-4 / 39 0-25-12 neat ans

112) 59052 (28) 527 (18 / 560 / 305 / 224 / 812 / 784 / 28 / 16 / 168 / 28 / 448 / 448 (4 oz

28 / 247 / 224 / 23 ... 4-2-23

lb £ S d cwt qr lb oz
112 : 2-15-4 :: 39-0-25-12

Case 4

2 In 8C 3qr 20 lb. gross tare 38 lb. trett 4 lb. in every 104 lb how many pounds neat: and wh at do they come to at 8 d 1/2 per lb.
Ans neat 925 lb. value 32 l 15 S 2 d 1/2

cwt qr lb 8-3-20 / 4 / 35 / 28 / 280 / 72 / gross 1000 / tare 38 / suttle 962 / trett 37 / neat 925

lb 26) 962 (37 trett / 78 / 182 / 182

lb d lb
1 : 8 1/2 :: 925

3 Bought 120C 2qr. gross of sugar: tare 176 lb trett 4 lb per 104 lb what is the neat weig ht and its value at 2 l 2 S 8 d per hundred weight
Ans neat 114C 1qr 17 lb value 244 l 13 S 6 d 3/4

cwt qr lb
120--2--0
4
482
28
3856
964
13496
176 tare
13320
512
2)12808(4 457
8)112 1114--1--12
160 neat
140
208
196
12

26)13320(512
130
32
26
60
52
8

lb £ S D cwt qr lb
112 : 3--3--8 : : 114--1--12

4 Sold 177C 22 lb gross tare 9lb. per hundred weight trett 4 lb. per 104 lb required the neat weight and its amount at 3l 14s. per hundred weight Ans neat 156C 2 qr 22 lb amount 579l 15s 6d 1/4

cwt lb
177--22
4
708
28
5666
1416
lb 19846
9
112)178614(1594
112
666
560
1061
1008
534
448
86

26)18252(702
182
52
52

lb
19846 tare
1594
18252 trett
702
28)17550(4)626
168 156--2--22
75 neat
56
190
168
22

lb £ S cwt qr lb
112 : 3--14 : : 156--2--22

Simple Interest

2 What is the interest of 87l 14s 5d for one year at 6 percent per anum. Ans 5l 5s 3d

£ S D
87--14--5
6
100)526--6--6
500 (5 £
26
20
)526(5 S
500
26
12
)318(3 D
300

3 What is the amount of 173l 17s 8½ for a year at 7 per cent per anum. Ans 186l 1s 1d 3/4 d

£ S D
173--17--8½
7
100)1217--3--11¼
100
217 (12
200
17
20
)343(3
300
43
12
)527(5
500
27
4
110(1/4
100
10

£ S D
173--17--8½
12--3--5¼
186--1--1¾
Ans

4 What will a bond for 176l 13s 9d amount to in nine years at 5 per cent per annum Ans 256l 3s 11d¼

£ s d
176 -- 13 -- 9
5
100|883 -- 8 -- 9
800 (8
83
20
|1668 (16 s
1600
668
600
68
12
|825 (8d
800
25
4
|100 (1/4

£ s d
8 -- 16 -- 8¼
9
79 -- 10 -- 2¼
176 -- 13 -- 9
256 -- 3 -- 11¼ Ans

Case 2.

2 Calculate the interest of a bond for 427l 18s 9d for 2 years at 5¼ per cent per annum Ans 49l 11s 3d.

£ s d
3|4½|½| 427 -- 18 -- 9
5
2139 -- 14 -- 9
¼| 213 -- 19 -- 4½
106 -- 19 -- 8¼
2460 13 -- 7¾
2
£ 49|21 -- 7 -- 3½
20
s 11|27
12
Ans d 3|27

3 What sum will 1096l 15s 6d amount to in 4 years at 6½ per cent per annum. Ans 1381l 18s 8d

£ s d
1096 -- 15 -- 6
6
6580 -- 13 -- 0
548 -- 7 -- 9
285|6 -- 3 -- 0
20
£ 3|23
12
d 2|76
4
3|04

£ s d
1096 -- 15 -- 6
285 -- 3 -- 2¾
1381 -- 18 -- 8¾
Ans

Case 3

2 What is the interest of 57l 17s 8d for three months at 6 per cent per annum Ans 17s 4d½

£ s d
57 -- 17 -- 8
6
£ 3|47 6 -- 0
20
s 9|46
12
d 4|52
4
f 2|08

M £ s d M
12 : 3 -- 7 -- 5½ :: 3

3 How much is the interest of 150l 19s for 3 years and 4 months at 6 per cent per anum. Ans 30l 3s 9d

£ s
150 -- 19
6
£ 9|05 -- 14
20
s 1|14
12
d 1|68
4
f 2|72

M £ s d M
12 : 9 -- 1 -- 1½ :: 40

4 What is the interest of 126l 12s for 10 weeks at 1½ per cent per annum Ans 1l 15s 0d½

£ s
½|½| 126 -- 12
4
506 -- 8
63 6
£ 5|69 -- 14
20
s 13|94
12
d 11|28
4
f 1|12

W £ s d W
52 : 5 -- 13 -- 11¼ :: 16

5 How much is the amount of 243l 17s for 146 days at 5¼ per cent Ans 249l 9s 2d.

£ S
3/4 1/2 | 1/2 | £43 -- 17
5
1/4 | 1/2 | 12 19 -- 5
1 21 18 -- 6
60 18 -- 3
£ 14|02 -- 1 -- 9
20
S 0|41
12
D 5|01

D £ S D D
365 : 14 -- 0 -- 5 :: 146

---

6 What is the interest of 71l 3s 11d½ for 1 year 5 months and 25 days at 6 per cent per anum.
Ans £6 5 10d 1/4

£ S D
71 -- 3 -- 11½
6
£ 4|27 -- 3 -- 9
20
S 5|43
12
D 5|25
4
f 1|00

D
25
M £ S D Y M
12 : 4 -- 5 -- 5¼ :: 1 -- 5

---

7 What is the amount of a bond for 116l 17s 2d. for 6 years 7 months and 19 days at 7 per cent per annum
Ans 171l 2s 7d.

£ S D
116 -- 17 -- 2
7
£ 8|18 -- 0 -- 2
20
S 3|60
12
D 7|22
4
88

M £ S D Y M D
12 : 8 -- 3 -- 7 :: 6 -- 7 -- 19

---

9 What sum will 674l 13s 8¾d amount to in 5 years 11 months and 28 days at 6 per cent per annum. Ans 917l 6s 1½d

m D
y 5 -- 11 -- 28
12
4|71
35½

£ S D
674 -- 13 -- 8¾
7 × 5 = 35½
10⅓ | 1/5 | 4722 -- 16 -- 1¼
5
2⅕ | 1/5 | 23614 -- 0 -- 6¼
½ 337 6 10¼
224 17 10¾
3)31½ 44 19 6¾
10 44 19 6¾
£ 2 42|66 -- 4 -- 4¾
20
S 13|24
12
D 2|92
4
f 3|71

£ S D
242 -- 13 -- 2¾
10
242 12 4¾
674 13 8¾
917 6 1½ Ans

---

10 What is the interest of 517 dollars ~~at 6 per cent per annum for 30 days Ans~~ for 30 days at 6 per cent per annum Ans 2,58

D
517
30
6(0)1551|0
2,58 Ans

---

11 What is the interest of 325 dollars at 6 per cent per annum for 64 days Ans 3,46

D
325
64
1300
1950
6(0)208|00
3,46 Ans

---

12 At 6 per cent what will the interest be of 100l from the 6th of the 7th month (July) to the ninth of the 1st month (January) Ans 3l 15s 9½d

£
100
6
£ 6|00

D
31
6
25
9
M £ M
12 : 6 :: 5 -- 34

---

13 Tell the interest of 240l for 1 year and 135 days at 7 per cent per annum Ans 23l 0s 3d

£
240
7
£ 16|80
20
S 16|00
£ D Y D
365 : 16 -- 16 :: 1 -- 135
20 365
336 135
500 500
365|16800

14 What is the interest of 371l for 1 year and 213 days at 6 per cent per annum
Ans 35l 5s 2d

£ 371
6
£ 22|26
20
s 5|20
12
d 2|40
4
f 1|60

D £ s D
365 : 22 - 5 - 2¼ :: 365
213
578

15 What is the interest of a bond for 325l 15s 6d. for 1 year and 73 days at 7 per cent per annum Ans 27l 7s 3d½

£ s D
325 - 15 - 6
7
£ 22|80 - 8 - 6
20
s 16|08
12
D 1|02

D £ s D D
365 : 22 - 16 - 1 :: 365
73
438

16 Required the interest of a bond for 148l 12s 6d½ for 11 months at 6 per cent per annum Ans 8l 3s 3d¾

m £ s d
2)11 148 - 12 - 6½
5½ 5½
743 - 2 - 8½
74 6 3¼
£ 8|17 8 11¾
20
s 3|48
12
D 5|87
4
f 3|51

17 What sum will a bond of 333l 13s 3¾d amount to in 17 months at 6 per cent per anum
Ans 362l 0s 6d½

m £ s D
2)17 333 - 13 - 3¾
8½ 8¼
2669 6 6
166 16 7¾
£ 28|36 3 1¾
20
s 7|23
12
D 2|77
4
f 3|11

£ s D
28 - 7 - 2¾
333 13 3¾
362 - 0 - 6½ Ans

18 A father left a legacy to his daughter of 651l 11s to be at interest until she attained the age of eighteen at his decease she was 15 years and 219 days old; what sum must she call on her executor for interest computed at 7 per cent per annum
Ans 761l 0s 2d½

years D £ s
18 - 000 651 - 11
15 - 219 7
2 - 146 £ 45|60 - 17
20
s 12|17
12
D 2|04

Days
365
2
730
146
D £ s D 876
365 : 115 - 12 - 2 :: 876

19 What interest is due on a legacy of 517l 12 8d½ for 5 years 11 months and 25 days at 6 per cent per annum
Ans 185l 17s 9d.

£ s D
517 - 12 - 8½
7×5 = 35½
3623 - 8 11½
5
18117 - 4 - 9½
258 - 16 - 11¼
172 - 10 - 10¾
34 - 10 - 2
8 - 12 - 6½
£ 185|91 - 4 - 8¾
20
s 18|32
12
D 4|16

£ s P
185 - 18 - 4
7
185 - 17 - 9 Ans

20 What is the interest of one farthing for 5794 years at 7 per cent per annum Ans 8s 5d¼

5 What may a broker dem and on 420 l 12 s 6 d at 6 s 4 d per cent. Ans 1 l 6 s 7 d 1/4

£ 420 - 12 - 6
20
8411
12
D 1/5 9
4
f 2/0 0

s D 5 | 4 | £ 4 - 4 - 1 1/2
6 - 4 | 1 | 1 1 0 1/4
| 5 | 4 2 1/4
| 3 | 1 4 3/4
ans 1 - 6 - 7 1/4

6 The value of a ship and cargo is 85600 dols what is the insurance at 35 per cent Ans 2996 0 dols.

D
85600
35
428000
256800
Ans 2996000

Case 5

2 What sum at interest for 9 years and 6 months at 4 1/2 per cent per annum will amount to 856 l 10 s? Ans 600 l.

£ 4 1/2
9 1/2
40 1/2
2 1/4
42 3/4
100
142 3/4 : 100 :: £ 856 1/2
4 4
571 342600
342600 (600 £
3426 ans

Case 6.

2 At what rate per cent will 600 dols. amount to 856 dols 50 cts in 9 years and 6 months Ans 4 1/2 per cent.

D C
D 856,50
600
600 : 256,50 :: 100 D
100
y 25650 00
4275
9 1/2
2
19,00) 8550 (4 1/2 Ans.
7600
950
2
1900 (1/2
1900

Case 7.

2 In what time will 600 l amount to 856 l 10 s at 4 1/2 per cent per anum. Ans 9 y. 6 m.

£
600
4 1/2
2400
300
£ 27 00

£ s
856 - 10
600
256 - 10
20
27 M
20) 5130 (9 y - 6 ans
540 4860
270
12
) 3240 (6 M
3240

3 a testator left his son besides providing for his education &c. 2000 dols to receive the amount thereof at 5 per cent when he should arrive at the age of 21 years which his guardian then found to be 2925 dols how old was the boy

at his fathers decease.
Ans 11 years 9 months.

D
2000 | 2925
5 | 2000 Y M
10000 | 100) 925 (9 -- 3
900
25
12
300 (3
300

Y M
21 -- 0
9 -- 3
11 -- 9 Ans

17 What is the interest of 2466l 16s 6d for 10 months at 4 per cent per annum

L S D
2266 -- 16 -- 6
4
9867 6 0
10
986(73 0 0

L L S D
900 = 75 -- 0 -- 0
80 = 6 13 4
6 = 10 0
1 2½
82 -- 4 -- 6½ ans

Rule

2 What is the interest of 2467l 10s for 12 weeks at 5 per cent per annum.

L S
2467 -- 10
5
12337 10
12
1480(50 0

L S D
1000 = 19 -- 4 -- 7¼
400 = 7 13 10
1 10 9¼
2½
ans 28 -- 9 -- 5

3 What is the interest of 2467l 10s. for 50 days at 6 per cent per annum

L S
2467 -- 10
6
14805 0
10
148850 0
5
744250 0

L S D
1000 = 19 -- 3 -- 6¾
400 = 1 -- 1 -- 11
¼
¼
20 -- 5 -- 7¼
ans

Compound Interest

~~2 What will 400l amount to in 4 years at 6 per cent per anum. Ans 17 80 dols for six years at 5 per cent per annum Ans 4~~

2 What will 400l amount to in 4 years at 6 per cent per annum Ans 504l 19s 9d ¼

		L	S D
1st 5	1/20	400 --	0 0
1	¼	20	0 0
		4	
2d 5	1/20	424	0 0
1	⅕	21	4 0
		4	4 9½
3d 5	1/20	449 -- 8 -- 9½	
1	⅕	22 -- 9 -- 5¼	
		4 -- 4 -- 10½	
4th 5	1/20	476 -- 8 -- 1½	
1	⅕	23 -- 16 -- 4¾	
		4 -- 15 -- 3¼	
		504 -- 19 -- 9¼ Ans	

3 how much is the compound interest of 1280 dols for six years at 5 per cent per anum Ans 435.32 2 mills.

D

5	1/20	1280
		64
5	1/20	1344
		672
5	1/20	14112
		7056
5	1/20	148176
		74088
5	1/20	1555848
		777924
5	1/20	16336404
		816822
		171153|224
		1280
		435,32,2 Ans

4 What will 500 l amount to in 4 years at 4 1/4 per cent per annum Ans 590 l 11 s 5 1/4 d

		L	S	D
4 1/4 4	1/25	500		
1/4	1/16	20	5	0
4	1/25	521	5	0
		20	17	
1/4	1/16	1	6	0 3/4
		543	8	0 3/4
4	1/25	21	14	8 1/2
1/4	1/16	1	7	1/2
		566	9	11 1/4
4	1/25	22	13	2 1/4
1/4	1/16	1	8	3 3/4
		590	11	5 1/4 Ans

5 What is the compound interest of 400 l 10 s at 3 1/2 per cent per annum for 3 years. Ans 43 l 10 s 8 3/4 d

		L	S	D
2	1/50	400	10	0
1	1/2	8	00	2 2/4
1/2	1/2	4	00	1
		2	00	0 1/2
2	1/2	414	10	3 3/4
1	1/50	8	5	9 1/2
1/2	1/2	4	2	10 3/4
	1/2	2	1	5 1/4
2	1/2	429	0	5 1/4
1	1/50	8	11	7 1/4
1/2	1/2	4	5	9 1/2
	1/2	2	2	10 3/4
		444	0	8 3/4
		400	10	
		43	10	8 3/4 ans

Rebate or Discount

2 What is the present worth of 430 dols 67 cts. for 19 months discount at 5 per cent Ans 399,07 cts.

M D M
12 : 5 :: 19
5
)95
7..91..6
100
107..91..6

D C M D D C M
107,91,6 : 100 :: 430,67.0

3 Sold goods for 795 l 11 s 2 d. to be paid 4 months hence; what is the present worth at 3 1/2 per cent Ans 786 l 7 s 8 d.

M L M
12 : 3 1/2 :: 4
20
70
4
12) 280
20) 23..4
1..3..4
100
101..3..4 : 100 :: 795..11..2

L L S D

4 What is the rebate of 112 l 12 s. for 20 months at 7 per cent Ans 11 l 15 s 3 0 1/2

m L m
12 : 7 :: 20
20
12) 140
11..13..4
100
111..13..4 : 100 :: 112..12

L L S

5 Sole goods for 832 dols one half to be paid at 3 months and the other half at 6 months: what must be discounted for present payment at 5 per cent Ans 15,28,5 mills.

m D m
12 : 5 :: 3
3
12)15
1.25
100
101,25 : 100 :: 2)832
416,00
100
)4160000(410864 Ans

m D m
12 : 5 :: 6
6
12)30
2,50
100
102,50 : 100 :: 2)832
416,00
100
)4160000(405853 ans

D c m
410864
405853
816717

832
816,71,7
Ans 15,28,3

6 What is the present worth of 100l. one half payable at 11 months and the other at 8 months; discount at 5 per cent Ans 97l 11s 4½d

m 12 : 5 :: 6
12)30
2..10
100
102..10 : 100 :: 100

7 What difference is there between the interes of 500 dollars at 5 per cent. per annum for 12 years and the discount of the same sum at the same rate and for the same time Ans 112,50

500
5
25|00
12
300
187.50
Ans 112,50

y D y
1 : 5 :: 12
12
60
100
160 : 100 :: 500
500
)50000(312,50

500
312,50
187,50

Equation

2 A merchant has owing to him 300l to be paid as follows viz 50l at 2 months 100l at 5 months and the rest at 8 months but it is agreed to make one payment of the whole: when will that time be Ans at 6 months

50 × 2 = 100
100 × 5 = 500
150 × 8 = 1200
300 3)1800
ans 6 months

3 F owes H 1000dol of which 200dol are to be paid present 400dol at 5 months and the rest at 10 months but they agree to make one payment of the whole and wish to know the time Ans 6 months

200 × =
400 × 5 = 2000
400 × 10 = 4000
1000) 6000
6 months ans

---

4 G owes F a sum of money which is to be discharged viz ¼ at 2 months ¼ at 4 months ¼ at 6 months and ¼ at 8 months: but they agreeing to make one payment of the whole the equated time is required Ans 5 months

50 × 2 = 100
50 × 4 = 200
50 × 8 = 400
50 × 6 = 300
200) 1000
5 Ans

---

5 E is indebted to F 240 dol which by agreement is to be paid 5 months hence but E is willing to pay him 40 dol present provided he will give him longer time to pay the remainder which is agreed on: the time of payment is therefore required Ans 6 months

240 × 5 = 1200
40
200) 1200
6 months ans

---

6 P owes Q 420 l which will be due 6 months hence but P is willing to pay him 60 l present provided he can have the remainder foreborne longer time to which Q agrees: the time of payment is required Ans 7 months.

420 × 6 = 2520
60
360) 2520 (7 months
2520

Barter

---

2 What quantity of tea at 10s per lb. must be given for 1cwt of chocolate at 4s per lb. Ans 44 lb 12 oz +

lb s lb
1 : 4 :: 112
4
s lb
10 : 1 ::) 448

---

3 How much rice at 28s per cwt. must be bartered for 3½ of raisins at 5d per lb. Ans 5 C. 3 qr 9 lb +

lb D cwt qr
1 : 5 :: 3 - 2
4
14
28
112
28
392
5
S cwt
28 : 1 :: 1960

---

4 A has linen cloth worth 20cts an ell ready money but in barter he will have 25cts B has broad cloth worth 2 dols per yard ready money: at what price ought the broad cloth to be rated in barter Ans 2,50 cts

C C C
20 : 25 :: 200
200
20)5000
250 Ans

5. Suppose C has tea at 8s 6d per lb ready money but in barter he will have 10s per lb D has tobacco worth 18d per lb ready money how must he rate his tobacco per lb to equal the tea in value Ans 1s 9d+

s D s D
8-6 : 10 :: 18
12 10 s D
102)180(1-9 Ans
102
78
12
936
918

6 A has nutmegs worth 1dol per pound ready money but in barter will have 106 cts per pound D has tobacco worth 10 cts. per lb ready money: how must D rate his tobacco that his profits may be equiveland with A's. Ans 106 mills.

C C C
100 : 106 :: 10
10
)1060(106 mills
100
60
600
600

7 A had 41 cwt of iron at 30s per cwt for which B gave him 20l in money and the rest in pork at 5d per lb how much pork must be given besides the 20l? Ans 1992 lb

cwt
41
30
20)1230
61-10
D lb 20
5 : 1 :: 41-10
20
830
12
5)9960
1992 lb Ans

8 A has 320 dozens of candles at 120cts per dozen for which B agrees to pay him 160 dols in cash and the rest in cotton at 20 cts per pound how much cotton must B give A Ans 1120lb.

320
120
6400
320
38400
C lb 160
20 : 1 :: 22400
1
)22400
1120 lb Ans

9. K has 75 Sheep at 14s 6d each for which L is to give him 17l 12s and the rest in Indian corn at 3s 6d per bushel; how much corn must L give K? Ans 210bu 4qt

s D
14-6×3
8×9=75
5 16 0
9
52 4 0
2 3 6
54-7-6
17 12
36 15 6
s D B L s D
3-6 : 1 :: 36-15-6

10 A and B bartered; A had 5C. of sugar at 6d per pound which he gave to B for a quantity of cinnamon at 10s 8d per pound how much cinnamon did B give A Ans 26lb 4oz.

cwt
5
4
20
20
160
s D lb 40
10-8 : 1 :: 3360
6
3360

11 B delivered 3 hogsheads of brandy at 6s 8d per gallon to C, for 126 yards of cloth: what was the cloth per yard

Ans 10s

gal. S D H
1 : 6-8 :: 3
63
189
80
yds 12)15120
126)1260(10 s Ans
126
0

12 C has candles at 12 s. per dozen ready money but in barter he will have 13 s per dozen. D has cotton at 18d per pound ready money: what price must the cotton be at in barter and how much must be bartered for 100 dozen of candles? Ans the cotton at 19d½ per pound and 800 lb must be given for 100 dozen candels.

S S D
12 : 13 :: 18
12 13
144 54
18
)234(1-7½ Ans
144
90
12
)1080(7
1008
72
4
)288(½
288

S D lb S
1-7½ : 1 :: 13
100
1300
12
15600
4
)62400(800 ans
624
00

13 A has linen at 10d the ell ready money but in barter 15 B has 3610 lb of sugar at 7d½ per lb. ready money and will have of A 35 l in cash and the rest in linen: at what rate is the sugar in barter and how much linen must A give B

Ans the sugar 9d and 1867½ ells.

D S D
10 : 1 :: 7½
4 12 4
40 12 30
30
40)360
9 ans

lb
3610
7½
25270
1805
12)27075
20)2256-3
112-16-3
D ell 35
10 : 1 :: 77-16-3
20
1556
12
10)18615
1867½ Ans

14 Two merchants barter: A receives 20 C. wt. of cheese at 21s 6d per cwt B 8 pieces of lien at 3 l 14s per piece which of them must receive money and how much Ans A 8 l 2 s.

S D
21-6 L S
4×5 20 3-14
4 6 0 8
5 29-12
21-10-0 21-10
8-2 Ans

15 If 24 yards of cloth be given for 5 C. 19 lb. of tobacco at 1 l 18 s per cwt what is the cloth rated at per yard Ans 8s 3d¾

cwt £ s
1 : 1 - 18 :: 5 - 1

4 20 4
4 38 21
21
38
76
4)798
199 - 6 (12
12
24)2394(99
8 - 3 3/4 Ans
216
234
216
18
4
72 (3/4

---

16 A barters 40 yards of cloth at 7s 4d per yard with B for 28½ lb of tea at 11s 6d per pound: which must pay balance and how much? Ans A 1£ 14s 5d

s D
7 - 4
5 × 8 = 40
1 - 16 - 8
8
14 - 13 - 4

s D
11 - 6 × ½
4 × 7 = 28½
4 - 6 - 0
7
16 - 2 - 0
5 9
16 - 7 - 9
14 13 4
1 - 14 - 5 Ans

---

17 A has 7½ cwt. of sugar at 8d per pound for which B gave him 12½ cwt. of cheese. what was the cheese rated at per pound ans 4d 3/4.

cwt qr
12 - 2
4
50
28
400
100
1400

lb D cwt qr
1 : 8 : 7 - 2 (112
4
30
28
240
60
840 ans
8
1400)6720(4 3/4
5600
1120
4
)4480(3

---

18 What quantity of sugar at 8d per lb. must be given in barter for 20 cwt. of tobacco at 3£ per hundred weight Ans 16 cwt 8 lb.

cwt £ cwt
1 : 3 :: 20
D lb 3
8 : 1 :: 60

---

19 B has coffee which he barters with Q a 10d per lb more than it cost him against tea which stands Q in 10s the lb. but puts it at 12s 6d. query the prime cost of the coffee. Ans 3s 4d.

s d D
12 - 6 s
10 :: 10 :: 10
2 - 6 : 10
12 10
30)100
3 - 4 Ans

---

20 A and B barter: A has 12½ cwt of hops at 2£ 16s per cwt but in barter insists on 3£ B has wine worth 5s a gallon which he raises in proportion to A's demand on the balance A received but a hhd of wine: what had he in ready money. ans 20£ 12s 6d.

£ s £ s
2 - 16 : 3 :: 5
20 5
56 15
20
)300(5 - 4¼ Ans
280
20
12
56)240(4s
20 224
1120(10 16
112 4
0)64(1f
56

cwt £ cwt qr
1 : 3 :: 12 - 2
112 4
50
28
400
100
1400
112)4200(37£
336
840
784
56

£ s D
5 - 4¼
7
1 - 17 - 5¾
9
16 - 17 - 3¾ hhd

£
37 - 10
16 17 - 3¾
20 - 12 - 8¼
Ans

Loss and Gain

2 Bought knives for 20cts each and sold them at 17cts each: how much is lost by the sale of 120 dozen? Ans 43,20cts.

nife 20 1 : 17 3 :: 120 dozen 12 1440 3 ans $ 43,20

3 Hats bought at 4s a piece and sold at 4s 9d. what is the gain per cent? Ans 18£ 15s.

s d 4 .. 9 £ s 4 : 4 .. 9 :: 100 20 2000 4 4)18 000 12)4 500 20)375 18 .. 15 ans

4 Bought 7 tuns of wine at 17 £ per hhd and sold it at 1s. per pint what is the whole gain and the gain per cent? Ans whole gain 229£ 12s per cent 11£ 4s 8d 4/4.

T 7 4 28 17 196 28 £476 pt s 1 : 1 :: 7 T 4 28 63 84 168 1764 8 20)141 12 705 .. 12 476 229 .. 12 Ans

hhd hhd 1/2 17 63 63 2 20)50 4 25 .. 4 £ 17 : 8 .. 4 :: 100 £ 20 164 100 17)16400 (964 £ 153 48 .. 4 .. 8 4/4 Ans 110 102 80 68 12 4 48 d

5 A draper bought 100 yards of cloth for 149 dols how must he sell it per yard to gain 51 dols in the whole? Ans 2 dols per yard.

D 100)149 (1,49 100 50 49 200 Ans 400 90 90

D 100)5100 (51cts 500 100 100

6 Bought 60 reams of paper at 2 dols per ream what is lost in the whole quantity at 4 per cent Ans 4,80 cts

reams 60 2 120 4 4,80 Ans

7 Sold 500 penknives at 15d a piece and 9 per cent lost what is lost in the whole number Ans 3£ 1s 9d 3/4

500
15
12)7500
20)625
£ 91 : 9 :: 31--5
20
1820
625
9
5625 (3 £
5460
165
20
3300 (1 S
1820
1480
12
17760 (9 d
16380
1380
4
5520 (3/4 f

8 Paid 69l. for 1 ton of steel what is the profit or loss on the sale of 14 tons retailed at 6d. per pound Ans 182l. loss.

£69
14
276
69
966
784
182 Ans £

T 14
20
280
4
1120
28
8960
2240
lb d
1 : 6 :: 31360
6
12)188160
20)15680
784

9 If a yard of cloth be bought for 13s 4d and sold for 16s. what is the gain per cent? Ans 20l

s d
13--4 : 16 / 13--4 / 2--8 :: 100 £
12 12 20
160 32 2000
12
24000
32
48000
72000
768000 (4800 (12)
640 20)400
1280 20
1280 ans
00

10 If 1c. of tobacco be bought for 4l 13s 4d. and sold at 11d per pound what is the gain or loss per cent ans 10 l gain.

lb
112
11
12)1232
20)102--8
5--2--8
4--13--4
£ s
4--13--4 : 9--4 :: 100 £
20 12 20
93 112 2000
12 12
1120 24000
112
48000
24000
24000
2688000 (2400 (12)
2240 20)200
4480 10
4480 ans

11 A draper bought 100 yards of cloth for 56l. how must he sell it per yard to gain 15l. per cent Ans 12s 10d1/2

£ £
10 | 10 | 56
5 | 1/2 | 5--12
2--16 y
y 100 : 64--8 :: 1
20
s 12 | 88 s d
12 12--10 1/2
d 10 | 56 ans
4
f 2 | 24

12 Sold 12 yards of cloth for 5l 14s by which was gained per cent what was the prime cost of a yard Ans 8s 9d1/2 +

£ s
4 | 25 | 5--14
4 | 25 | 4--6 1/2
4--6 1/2
9--1
£ s
5--14
9--1
5--4--11
20
12)104 (8 s
96 11
8 4
12 44 (3/4 f
107 (8 d 36
11 8

13 Having bought a parcel of goods for 18 l and sold the same immediately for 25 l with 4 months credit: what is gained per cent per annum? Ans 116 l 13 s 4 d.

£ 25
18
7
3
£ 18 : 21 :: £ 100
100
12) 2100 (116 £
18
30
18
120
108
12
20
12) 240 (13 s
...
(4 d

---

14 Bought 300 lbs. of coffee at 4 s 2 d. per lb. ready money and sold it at 5 s. per pound payable in 8 months. how much was gained on the whole allowing discount at 6 percent and how much percent per annum?

ans { 9 l 12 s 3 d 1/2 whole gain
{ 30 percent

lb 300 at 5 s
20) 1500
75 " 0
12 " 10
12 " 10

lb 300
50 d
12) 15000
20) 1250
62 " 10

in m
12 : 6 :: 8
8
12) 48
4
100
104 : 100 :: 75 = 72 " 2 " 3 1/2
62 " 10
Ans 9 " 12 " 3 1/2

£ s 62 " 10 } £ s 12 " 10 } £ 100
8 m } 12 months
500
1200
12 1/2
14400
500) 15000
ans 30 per cent

---

15 If when cloth is sold at 7 s per yard there is gained 10 per cent. what will be the gain per cent when it is sold for 8 s 6 d. per yard? Ans 33 l 11 s 5 d.+

s
10
100
110 : 100 :: 7
7
110) 700 (6 s " 4 4/11 d oregenal price
660
40
12
480 (4
440
40
11) 40

s d
8 " 6
6 " 4 4/11
6 " 4 4/11 : 2 " 1 7/11 :: £ 100
12 12 20
76 25 2000
11 11 12
840 282 24000
11
264000
282
528000
2112000
528000
840) 74448000 (88628
12) 8057
2|0) 67|4 " 5
Ans 33 " 11 " 5
£ s d

---

16 Bought a chest of tea weighing 490 lb for 326 dols and sold it for 370,10 cts. what was the profit on each lb. Ans 9 cts

D C
370,10
326
490) 4410 (9 cts Ans
4410

---

17 Bought 12 pieces of white cloth for 6 l 10 s. per piece paid 20 s 10 d a piece for dying: for how much must i sell them each to gain 20 percent? Ans 9 l 1 s.

£ s D
6 " 10 " 0
1 " 0 " 10
20 | 4 | 7 " 10 " 10
| 5 | 1 " 10 " 2
9 " 1 " 0 Ans

---

18 If 28 pieces of stuff be purchased at 4 l. per piece and 10 of them sold at 6 l and 8 at 5 l per piece: at what rate must the rest be disposed of to gain 10 per cent. by the whole? Ans 2 l 6 s 4 d 3/4

pieses 28, 4 — 112; pieses 10, 6 — 60, 40 — 100; pieses 8, 5 — 40

10)112 (11..4, 12..0
10)23..4 (2..6..4 3/4 Ans
20
3
20
)64(6 s
60
4
12
)48(4 d
40
8
4
)32(3/4 f

S P 6..4 4/11 : 5/6 P 6..4 4/11 :: 100 £

6..4 4/11 × 12 = 76, × 11 = 840

100 × 20 = 2000, × 12 = 24000, × 11 = 264000, × 48 = 2112000 / 1056000

84(0)12672000(15085 5/7
84
427
420
720
672
480
420
12) 60 = 5 / 84 = 7

(11) 15085 5/7
(12) 1371 33/77 = 3/7
(20) 114..3
5..14..3 3/7 ans

---

19 Sold a yard of cloth for 11 s 6 d. by which was gained at the rate of 15 per cent. but if it had been sold for 12 s what would have been the gain per cent?
Ans 20 £.

15 / 100 / 115 : 100 :: 11..6 (s d)
115 × 12 = 1380; 11..6 × 12 = 138, 100
138(0)1380(00 (10 s oregenal
138

s 10 : 12 s − 10 = 2 :: 100 £
20
2000
2
(10)400(0
(20)400
20 £ Ans

---

20 If when cloth is sold at 7 s. a yard the gain is 10 l. 6 s. a yard? Ans 5 l 14 s 3 d 3/4 lost.

£ 10 / 100 / 110 : 100 £ :: 7 s
110 × 20 = 2200; 100 × 20 = 2000
2000 × 7 = 14000
22(00)140(00 (6..4 4/11 S P
132
8
12
)96(4 d
88
2) 8 = 4 / 22 = 11

---

21 At 1 d 1/2 per shilling profit how much per cent?
Ans 12 l 10 s

S D £
1 : 1 1/2 :: 100
20
2000
6
4)12000
12)3000
20)250
12..10 Ans

---

22 At 3 s 6 d. in the pound profit how much per cent
Ans 17 l 10 s

£ S D £
1 : 3..6 :: 100
12
42
100
12)4200
20)350
17..10 Ans

---

23 If by selling 1 lb. of pepper for 10 d 1/2 there is 2 d. lost, how much is the loss per cent?
Ans 16 l.

D D £
12 1/2 : 2 :: 100
4
50
20
2000
12
24000
4
96000
2
5(0)19200(0
12)3840
20)320
16 Ans

24 A merchant receved from Lisbon 180 casks of raisins which stand him here in 16s each; and by selling them at 28s per Cwt he gains 25 per cent required the weight of each cask one with another? Ans 80lb.

casks 180 × 16s = 2880 ; 20)2880 = 144 ; 144 × 25 = 3600 ; Interest 36|00 ; £ 144 + 36 = 180

s 28 : cwt 1 : £ 180 ; 180 × 20 = 3600 ; 28)3600(128 cwt 2 qr 8 lb

cwt qr lb 128 . 2 . 8 ; × 4 = 514 ; × 28 = 14400 ; casks 180)14400(80lb Ans

Fellowship 1823

H put in stock 1800 dols B advanced 4 months after required the sum he put in so as at the years end to claim equal profits with A? Ans 2700 dols

m 12 − 4 = 8 : D 1800 :: m 12 ; 8)21600 ; ans 2700

5 A. B. and C join stocks for 12 months; A puts in 100l and the first of the fifth month 150l. more. and on the first of the ninth month takes out 30l B puts in 250l on the first of the sixth month 60l more and on the first of the eleventh month 100l more C puts in 300l on the first of the fourth month takes out 200l and on the first of the eighth month takes out 50l more the whole gain is 133l what is each partner's proper share of it? Ans A must have 40l 14s 0d 3/4 B 64l 12s 6d C 27l 13s 5d.

```
 L                    L                          L
100                  250                        300
 12                   12                         12
----                 ----                       ----
1200                 3000   60×7                3600
1200 = 150×8          420   100×2               1800  200×9
----                  200                       ----
2400                ----                        1800
 120  30 ×4         B 3620                       250  50×5
----                                            ----
A 2280                                          C 1550
3620
1550
----
A 7450 : L 133 :: 2280
                    133
                   ----
                   6840
                  6840
                 2280
                 ------
7450)303240(  L  s  d
     29800   40..14..03/4 Ans
     -----
      5240
        20
     ------
    104800(14 s
     7450
     -----
     30300
     29800
     -----
       500
        12
      ----
      6000(0 d
      4
     24000(3 f
```

6 A, B, and C made a stock for 12 months; A put in at firs 364l. and four months after he put in 40l. more; B put in at first 408l. and at the end of 7 months he took out 86l. C put in at first 148l. and three months after he put in 86l. and 5 months after that he put in 100l more; and at the end of 12 months their gain is found to be 1436l. what is each man's share thereof? Ans A 556l 3s 6d½. B 529l. 16s 9d¼. C 349l 19s 8d.

```
 L                  L                         L
364                408                       148
 12                 12                        12
----               ----                      ----
4368               4896                      1776
 320  40×8          430  86×5                 774  86×9
----               ----                       400  100×4
A 4688             B 4466                    ----
4466                                         2950
2950
-----
12104 : L 1436 :: 4688
              4688
             -----
             11488
            11488
            8616
           5744
           -------
12104)6731968(  L     s    d
      60520      556.. 3.. 6½
      -----
       67996
       60520
       -----
        74768
        72624
        -----
         2144
           20
        -----
        42880(3 s
        36312
        -----
         6568
           12
        -----
        78816(6 d
        72624
        -----
         6192
            4
        -----
        24768(2 f
```

7 A, B, and C join in company; A's stock is 50l. for 12 months, B's 160 yards of cloth 8 months, and C's 240 bushels of wheat 7 months; their gain is such, that A and B's share is 456l B and C's 431l. C and A's 375l — Required the whole gain; each ones respectively; the price of B's cloth per yard, and what C's wheat was per bushel? ANS whole gain 631l. A's share 200l B's 256l. and C's 175l. B's cloth 12s. per yard and C's wheat 6s 3d. per bushel.

A & B { 456 .... £ 456, 3, 1368, 600, 768

B & C { 431 .... 431, 3, 1293, 768, 525

C & A { 375

£ 2)1262, 631

Months 50, 12 months

12 ÷ 600 = 50 A

8 ÷ 768 = 96 B } Stock

7 ÷ 525 = 75 C

£

1893 : 631 :: 600

600

378600 (200 A Share

3786

00

1893 : 631 :: 768 = 256 B Share

1893 : 631 :: 525 = 175 C Share

Yards 160) 96 B Stock £ S

20 (0 .. 12 ANS

1920

1920

£ S D

Bushels 240) 75 (0 .. 6 .. 3 ANS

20

1500

1440

6 12

720 (3 d

720

Exchange.

2 What is the value of a bill of 750l Pennsylvania or or ther [illegible] like currency in New York or North Carolina currency? Ans 800 l.

s d s L L
7-6 : 8 :: 750 : 800 Ans

3 what sum of New york currency is equal to 173l 16s. in New jersey?
Ans 185 l 7s. 8 d 3/4

s d s L s
7-6 : 8 :: 173-16

4 Exchange for 375 l. Pennsylvania currency. Thirty days after sight pay to Charles Jack son or order three hundred seventy-five pounds pennsylvania currency as per advise from they frend Peter Smpson To Benyaman Brown Marchant Virginia

How much Virginia currency will discharge the above bill Ans 300l

s d s L
7-6 : 6 :: 375
20
7500
12
90000
6
90/540000
20)6000
300 Ans

5 B. of Massachusetts received in pennsylvania currency the following sums viz 76l. 17s 8d-200 l-and 170l 10s 11d what sum is equal thereto in the state he resides in? Ans 357l 18s 10d 1/2.

L s d
76--17-- 8
200
s d s 170--10--11
7-6 : 6 :: 447--8--7

6 How much South Carolina currency is equal to 1500 l of New Jersey? Ans 933l 6s 8d.

s d s d L
7-6 : 4--8 :: 1500

7 A merchant in New york owes 240l to a planter in virginia; how much ought he to be charged with in the planters books Ans 180l.

s s L
8 : 6 :: 240

8 Exchange for 562l 13s 8d.

Twelve days after sight please to pay to David Davis or order five hundred and sixty-two pounds thirteen shillings and eight pence value received; and place the same to account as per advice from they friend Isaac Jones.

To Bradshaw Watson. what sum Georgia currency will discharge this bill Ans 328l 4s 7d 1/2

s d L s d
8 : 4-8 :: 562--13--8

9 C of Connecticut draws on D of Delaware for 1011 l 16s 9d. what sum in the latter currency will pay this draught? Ans 1316 0s 11d 1/4

s s d L s d
6 : 7-6 :: 1011--16--9

10 What sum New-york currency is equal to 180l in massachusetts? Ans 240l.

s s L
6 : 8 :: 180

11 How much South Carolina currency is equal to 360l. Massachusetts money
Ans 280l. S S D 6 : 4 - 8 :: 360

12 A Bill of exchange for 475l. being remitted from Georgia to New-jersey; what is the value of it in Jersey currency? Ans
763l 7s 10d 1/4
S D S D L
4-8 : 7-6 :: 475

13 If 472l 16s 8d. be transmitted from Georgia to North carolina; what sum is it equal to in the latter state
Ans 810l 11s 5d 1/4
S D S L S D
4-8 : 8 :: 472 - 16 - 8

14 How much Virginia currency will purchase a bill for 280l. South Carolina currency? Ans 360l.
S D S L
4-8 : 6 :: 280

15 What is 96l 16s 9d 3/4 of Chaleston, South Carolina worth in New-york? Ans 166l 0s 3d.
S D S L S D
4-8 : 8 :: 96-16-9 3/4

16 Reduce 36791l 14s 4d. of New-york to New Jersey currency. Ans 34492l 4s 8d 1/4
S S D L S D
8 : 7-6 :: 36791 - 14 - 4

Case 2

3 Jamaica is indebted to London 1470l 12s 8d. sterling with how much currency will London be credited at Jamaica when the exchange is at 36 1/2 per cent? Ans 2007l 8s 2 3/4

		L	S	D
25	1/4	1470	12	8
10	1/10	367	13	2
1	1/10	147	1	3
1/2	1/2	14	14	1 1/4
		7	7	0 1/2
		2007	8	2 3/4

Ans

4 Dubblin draws upon London for 740l 14s 6d. Irish exchange at 12 per cent. how much sterling will dischrge this ~~exchange at 12 per cent how much sterling will discharge this~~ bill? Ans 661l 7s 2d 3/4
L
12
100 L L S D
112 : 100 :: 740 - 14 - 6

5 London remits to Ireland 651l 14s 11d 3/4 sterling? how much Irish must London be credited exchange at 12 per cent? Ans 729l 19s 2d.
L L L S D
100 : 112 :: 651 - 14 - 11 3/4
20 20
2000 13034
12 12
24000 156419
4 4
96000 625679
112
1251358
625679
625679
) 70076048 (729 - 19 - 2 (L S D)
672000
287604
192000
956048
864000
92048
20
) 1840960 (19 S

6 Exchange for 452 l 10 s 6 d. sterling. Thirty days after sight of this my first of exchange second and third of like tenor and date not paid pay to Samuel Sims or order four hundred fifty-two pounds ten shillings and six pence sterling value received: and place the same to account as per advice from Peter Simpson
Samuel Pimm, Merchant, London
What is the value of this bill in Pennsylvania currency exchange at 77 1/2 per cent? Ans 803 l 4 s 7 d 1/2

77..10
100
£ 100 : 177..10 :: £ s d 452..10..6

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7 In a settlement between C of Philadelphia and D of London C is indebted 750 l 2 s 4 d 1/2 sterling; what sum Pennsylvania currency is equivalent exchange at 78 per cent? Ans 1335 l 4 s 2 d 1/2

£ 100 : 78/100 178 : : £ s d 750..2..4 1/2

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8 How much sterling is equal to 1341 l 9 s 4 d 3/4 Pennsylvania currency exchange at 67 1/2 per cent? Ans 800 l 17 s 6 d 1/2

67..10
100
167..10 : £ 100 : : £ s d 1341..9..4 3/4

---

9 What sum sterling will be equal to 260 l 8 s 6 d. Virginia currency exchange at 44 per cent? Ans 180 l 17 s.

44
100
144 : £ 100 : : £ s d 260..8..6

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10 Purchased in Ireland effects to the value of 1100 l 17 s 9 d. of that place; what sum, Pennsylvania currency will discharge the debt exchange at 51 1/2 per cent? Ans 607 l 6 s 10 d 1/2

51..10
£ 100 : 100
151..10 : : £ s d 1100..17..9

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11 Exchange for 4226 livers 12 sols 8 deniers. Thirty days after sight of this my second of exchange first of the same tenor and date not paid, pay to Thomas Broke or order four thousand two hundred and twenty six livers twelve sols and eight deniers value received; and place the same to account, as per advice from Silas Strow To Thomas Lamott Marchant London
How much sterling is the above bill at 10 d 1/2 per liver? and what sum in Pennsylvania currency at 17 d 1/2 per liver?

ans £ s d
184..18 3 1/2 sterling.
308 3 10 currency.

livre D livres sols deniers
1 : 10 1/2 : : 4226..12..8
20 4 20
20 42 84532
12 12
240 1014392
42
20287841
4057568
240) 42604464 (177518
240
1860
1680
1804
1680

4) 177518
12) 44379..1/2
20) 3698..3
184..18..3 1/2

Ans

12 A Connecticut merchant imported goods from france amounting per invoice to 49008 livres; how much currency of that state at 15d per liver; will they amount to: and how much sterling will discharge the debt excange being at per?

Ans {3063 0 0 currency; 2297 5 0 Sterling. (£ s d)

Liver D Livers
1 : 15 :: 49008
15
245040
49008
12)735120
20)61260
s D s
1..4 : 1 :: 3063..0..0 currency
12 20
16 61260
12
16)735120
20)45945
2297..5 Sterling

13 A mechant in Holland being desirous to turn 4376 florines currency into banco, the ag is at 4 per cent. how many pounds Flemish banco must he receive? Ans 701 l. 1 fl. 13 sti. 13 pen.

104 : 100 :: 4376
100 (6) Florins P
437600 (4207..13..13
416 701..1..13..13
216 £ ans
208
800
728
72
20
1440 (13
104
400
312
88
16
528
88
1408 (13
1352

14 B, of ~~Philade~~ Philadelphia receves of A of Amsterdam an invoice of goods amounting to 10235 flo. 17 sti. 8 pen. how much pennsylvania crrency must be remitted to discharge the bill at 35d¼ per florin? And what is the sum in sterling exchange at 33s 6d. flemish per £ sterling?

ans {1503..7..10½ currency; 886 4 5½ Sterling (£ s d)

flo D flo sti pen
1 : 35¼ :: 10235..17..8
20 4 20
20 141 204717
16 16
120 1228310
20 204717
320 3275480
141
3275480
13101920
3275480
320)461842680 (1443258
32 360814..½
141 20)30067..10
128 1503..7..10½
138 Currency
128
104
96
82
64
186
160
268
256

£ s D £ flo sti pen
33..6 : 1 :: 10235..17..8
12 20
402 204717
8 16
3696 1228310
204717
3275480 (886 £
29568
31868
29568
23000
22176
824
20
16480 (4 s
14784
1696
12
20352 (5 D
18480
1872
4
7488 (2 f
7392

15 A bill for 2524 pezos. 7 ria 33 marv being remited to Cadiz: what sum Pennsylvania curre ncy is equal thereto at 7s 6d. per pezo? Ans 946 17s 5d 1/2

pezo £ D pezos ria marv
1 : 7..6 :: 2524..7..33
8 12 8
8 90 20199
34 34
272 80799
60600
686799/90

272) 61811910 (227249 1/2
(20) 11893 7..5 1/2
946..17..5 1/2
L Ans

16 A Virginia merchant sent goods to Norway worth 1743l 16s Virginia currency: how many rix dollars at 6s each must he receive? Ans 5812 dols. 4s.

S rixdol £
6: 1 :: 1743..16
20
6) 34876
5812..4 Ans

17 A merchant of North Carolina shipped a quantity of flour which when disposed of amounted to 1186 millreas 500 reas; and received in return 17 pipes of wine; what was it per pipe a millrea reckoned at 7s 6d. Ans 26l 3s 5d 1/4

millrea S D mill reas
1: 7..6 :: 1186..500
1000 12 1000
1000 90 1186500
90
12) 106785000
20) 8898..9
Pipes 17) 444..18..9
34
104 (26 L
102
2
20
17) 58 (3 S
51
7
12
17) 93 (5 P
85
8
4
32 1/4

18 In 2714 guilders 15 stivers, how many pounds sterling; exchange at 35s 6d flemish per L. Sterling?
Ans 254l 18s 1d 1/4

S D £ guil sti
35..6 : 1 :: 2714..15
12 20
426 54295
2
108590 (254
852 L
2339
2130
2090
1704
386
20
) 7720 (18 S
426
3460
3408
52
12
624 (1 P

19 In 290l 11s 10d sterling how many pounds flemish exchange at 33s 10d flemish per L. Sterling and agio at 4 1/2 percent Ans 513l 14s 1d.

L S D L S D
1 : 33..10 :: 290..11..10
20 12 20
20 406 5811
12 12
240 69742
406
418452
2789680
240) 2831 5252 (11798 0
240 (20) 9831..8
431 491..11..8
4 1/2
1966.6.8
245.15.10
L 22) 12..2..6
20
S 2) 42
12
P 5) 10

L S D
491..11..8
22 2 5
513..14..1 ans
L